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ANTHROPOMETRY OF THE CLOTHED US ARMY GROUND TROOP AND COMBAT VEHICLE CREWMAN

BY
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) In order to make estimates of the spatial allowances needed for the clothed and fully equipped crew and passengers of a ground combat vehicle, anthropometric data were collected on five nude male soldiers who approximated the percentile range of US Army men and US Army armor crewmen on height and weight. Anthropometric data were also collected on the same individuals when they were outfitted in each of four ground combat vehicle crewman's clothing ensembles and each of four passenger (ground troop) clothing ensembles. The crewman's ensembles were for hot weather, hot weather with		

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chemical protection, extreme cold weather, and extreme cold weather with chemical protection. The ground troop clothing ensembles were the same with the addition of load-carrying equipment. For each of 28 body dimensions, a difference score was calculated to reflect the changes in body size as a function of donning each clothing ensemble. Predicted measurements of the clothed body were then generated for each of the eight clothing ensembles.

PREFACE

The work reported here was conducted by the Human Factors Group, Individual Protection Laboratory. The late Mr. Robert M. White provided invaluable technical advice during the planning of this investigation. Early stages of this work were supported in part by funds from the US Naval Sea Systems Command under the project Amphibious Environment Crew Protection Requirements. SP5 Forrest L. Walker and SP5 Stanley M. Walker assisted in the collection and analysis of the data. The author is now with the Health and Performance Division, US Army Research Institute of Environmental Medicine, Natick, Massachusetts 01760.

TABLE OF CONTENTS

	Page
LIST OF TABLES	vii
LIST OF FIGURES	xi
INTRODUCTION	1
PROCEDURE AND RESULTS	2
DISCUSSION	6
SUMMARY AND CONCLUSIONS	7
TABLES	9
FIGURES	55
REFERENCES	83
APPENDIX	85

LIST OF TABLES

Table	Page
1. Combat Vehicle Crewman's Clothing for Hot Weather.	10
2. Combat Vehicle Crewman's Clothing for Hot Weather and Chemical Protection.	11
3. Combat Vehicle Crewman's Clothing for Extreme Cold Weather.	12
4. Combat Vehicle Crewman's Clothing for Extreme Cold Weather and Chemical Protection.	13
5. Ground Troop Clothing for Hot Weather.	14
6. Ground Troop Clothing for Hot Weather and Chemical Protection.	15
7. Ground Troop Clothing for Extreme Cold Weather.	16
8. Ground Troop Clothing for Extreme Cold Weather and Chemical Protection.	18
9. Each Subject's Percentile Rankings Based on Stature and on Weight for Two Reference Populations.	20
10. Mean Values of the Male Soldier Sample for Each Anthropometric Dimension.	21
11. Mean Changes in Anthropometric Measurements Imposed by Combat Vehicle Crewman's Clothing for Hot Weather.	22
12. Mean Changes in Anthropometric Measurements Imposed by Combat Vehicle Crewman's Clothing for Hot Weather and Chemical Protection.	23
13. Mean Changes in Anthropometric Measurements Imposed by Combat Vehicle Crewman's Clothing for Extreme Cold Weather.	24
14. Mean Changes in Anthropometric Measurements Imposed by Combat Vehicle Crewman's Clothing for Extreme Cold Weather and Chemical Protection.	25

LIST OF TABLES (continued)

Table	Page
15. Mean Changes in Anthropometric Measurements Imposed by Ground Troop Clothing for Hot Weather.	26
16. Mean Changes in Anthropometric Measurements Imposed by Ground Troop Clothing for Hot Weather and Chemical Protection.	27
17. Mean Changes in Anthropometric Measurements Imposed by Ground Troop Clothing for Extreme Cold Weather.	28
18. Mean Changes in Anthropometric Measurements Imposed by Ground Troop Clothing for Extreme Cold Weather and Chemical Protection.	29
19. Predicted Anthropometric Measurements (in centimeters) of the US Army Armor Crewman Dressed for Hot Weather.	30
20. Predicted Anthropometric Measurements (in centimeters) of the US Army Armor Crewman Dressed for Hot Weather and Chemical Protection.	31
21. Predicted Anthropometric Measurements (in centimeters) of the US Army Armor Crewman Dressed for Extreme Cold Weather.	32
22. Predicted Anthropometric Measurements (in centimeters) of the US Army Armor Crewman Dressed for Extreme Cold Weather and Chemical Protection.	33
23. Predicted Anthropometric Measurements (in centimeters) of the US Army Man Dressed in Ground Troop Clothing for Hot Weather.	34
24. Predicted Anthropometric Measurements (in centimeters) of the US Army Man Dressed in Ground Troop Clothing for Hot Weather and Chemical Protection.	36
25. Predicted Anthropometric Measurements (in centimeters) of the US Army Man Dressed in Ground Troop Clothing for Extreme Cold Weather.	38
26. Predicted Anthropometric Measurements (in centimeters) of the US Army Man Dressed in Ground Troop Clothing for Extreme Cold Weather and Chemical Protection.	40
27. Predicted Anthropometric Measurements (in inches) of the US Army Armor Crewman Dressed for Hot Weather.	42

LIST OF TABLES (continued)

Table	Page
28. Predicted Anthropometric Measurements (in inches) of the Army Armor Crewman Dressed for Hot Weather and Chemical Protection.	43
29. Predicted Anthropometric Measurements (in inches) of the US Army Armor Crewman Dressed for Extreme Cold Weather.	44
30. Predicted Anthropometric Measurements (in inches) of the US Army Armor Crewman Dressed for Extreme Cold Weather and Chemical Protection.	45
31. Predicted Anthropometric Measurements (in inches) of the US Army Man Dressed in Ground Troop Clothing for Hot Weather.	46
32. Predicted Anthropometric Measurements (in inches) of the US Army Man Dressed in Ground Troop Clothing for Hot Weather and Chemical Protection.	48
33. Predicted Anthropometric Measurements (in inches) of the US Army Man Dressed in Ground Troop Clothing for Extreme Cold Weather.	50
34. Predicted Anthropometric Measurements (in inches) of the US Army Man Dressed in Ground Troop Clothing for Extreme Cold Weather and Chemical Protection.	52

LIST OF FIGURES

Figure	Page
1a. Combat Vehicle Crewman's Clothing for Hot Weather (Front View)	56
1b. Combat Vehicle Crewman's Clothing for Hot Weather (Side View)	57
2a. Combat Vehicle Crewman's Clothing for Hot Weather and Chemical Protection (Front View)	58
2b. Combat Vehicle Crewman's Clothing for Hot Weather and Chemical Protection (Side View)	59
3a. Combat Vehicle Crewman's Clothing for Extreme Cold Weather (Front View)	60
3b. Combat Vehicle Crewman's Clothing for Extreme Cold Weather (Side View)	61
4a. Combat Vehicle Crewman's Clothing for Extreme Cold Weather and Chemical Protection (Front View)	62
4b. Combat Vehicle Crewman's Clothing for Extreme Cold Weather and Chemical Protection (Side View)	63
5a. Ground Troop Clothing for Hot Weather (Front View)	64
5b. Ground Troop Clothing for Hot Weather (Side View)	65
5c. Ground Troop Clothing for Hot Weather with the Large ALICE Pack and Frame (Front View)	66
5d. Ground Troop Clothing for Hot Weather with the Large ALICE Pack and Frame (Side View)	67
6a. Ground Troop Clothing for Hot Weather and Chemical Protection (Front View)	68
6b. Ground Troop Clothing for Hot Weather and Chemical Protection (Side View)	69
7a. Ground Troop Clothing for Extreme Cold Weather (Front View)	70
7b. Ground Troop Clothing for Extreme Cold Weather (Side View)	71

LIST OF FIGURES (continued)

Figure	Page
7c. Ground Troop Clothing for Extreme Cold Weather with the Large ALICE Pack and Frame (Front View)	72
7d. Ground Troop Clothing for Extreme Cold Weather with the Large ALICE Pack and Frame (Side View)	73
8a. Ground Troop Clothing for Extreme Cold Weather and Chemical Protection (Front View)	74
8b. Ground Troop Clothing for Extreme Cold Weather and Chemical Protection (Side View)	75
9. Body Dimensions	76
10. Body Dimensions (continued)	77
11. Body Dimensions (continued)	78
12. Head Dimensions	79
13. Foot Dimensions	80
14. Hand Dimensions	81
15. Hand Dimensions (continued)	82

ANTHROPOMETRY OF THE CLOTHED US ARMY GROUND TROOP AND COMBAT VEHICLE CREWMAN

INTRODUCTION

In order for the crew and passengers of combat vehicles to perform at optimal levels, it is necessary that seating arrangements, hatch openings, crew seats, compartments, etc. be able to accommodate soldiers of varying sizes. Moreover, the vehicles must also accommodate the various items of clothing and equipment the soldiers wear or carry. The clothing and equipment used by crew and passengers (troops) will vary as a function of the demands of the natural environment (e.g., extremes of heat and cold) and/or the demands of the specific military operation being conducted (e.g., whether the vehicle is in a chemically contaminated environment).

Anthropometric data on the amount of space required for each person in a combat vehicle are essential input for the development of an efficient man-vehicle system. The U.S. Army has collected large amounts of data on the anthropometric dimensions of the individual soldier, both male and female (cf. White^{1,2}). However, virtually all these data were collected on nude soldiers in order to determine sizing tariffs for individual clothing and personal equipment. When the planning of the dimensions of the interiors of vehicles is carried out, nude body dimensions of the crew and passengers are inadequate approximations of the space to be occupied by each individual.

Little work has been done in terms of determining the clothed body dimensions of the U.S. soldier. MIL-STD-1472C (Human Engineering Design Criteria for Military Systems, Equipment and Facilities)³ and MIL-HDBK-759 (Human Factors Engineering Design for Army Materiel)⁴, for example, present anthropometric data based mainly upon nude dimensions with the caveat that "suitable allowances shall be made for light or heavy clothing, flying suits, helmets, boots, body armor, load-carrying equipment, protective equipment, and other worn or carried items, when utilizing these data for design criteria" (MIL-STD-1472C, page 139). These publications present scant objective guidelines as to how much additional space is to be allowed for clothing and equipment.

Some data on the space occupied by the arctic-clothed soldier have been systematically collected⁵, but these data are limited to the infantryman's clothing and were collected with the subject wearing an arctic ensemble which is now out of date. Furthermore, these data do not take into account the web gear, canteen, ammunition, intrenching tool, and other items which the combat soldier would be expected to wear or carry.

The present report is an attempt to estimate the magnitudes of allowances which must realistically be made for the latest US Army combat clothing and equipment when worn or carried by the crew and passengers of a ground combat vehicle. The approach was (a) to collect anthropometric data on a small number of nude male soldiers (who approximate the range of the US soldiers in height and weight), (b) to clothe them in selected combat clothing ensembles, and (c) to determine for each body dimension the mean difference between the nude and the clothed measurements for each ensemble. These mean difference

scores would reflect the changes in nude body dimensions as a function of donning combat clothing. Lastly, these mean difference scores would then be used (d) to generate tables of predicted anthropometric measurements of the fully dressed ground combat soldier.

PROCEDURE AND RESULTS

The Clothing Ensembles

Since the occupants of a ground combat vehicle (a) may be either crew or ground troops (passengers), (b) may be dressed for either hot or cold weather, and (c) may be dressed for either a chemically clean or a chemically contaminated environment, they may be dressed in any one of eight basic ground combat clothing ensembles. These eight ensembles were selected for evaluation and are as follows:

1. Combat vehicle crewman's clothing for hot weather (see Table 1 and Figures 1a and 1b);
2. Combat vehicle crewman's clothing for hot weather and chemical protection (see Table 2 and Figures 2a and 2b);
3. Combat vehicle crewman's clothing for extreme cold weather (see Table 3 and Figures 3a and 3b);
4. Combat vehicle crewman's clothing for extreme cold weather and chemical protection (see Table 4 and Figures 4a and 4b);
5. Ground troop clothing for hot weather (see Table 5 and Figures 5a, 5b, 5c, and 5d);
6. Ground troop clothing for hot weather and chemical protection (see Table 6 and Figures 6a and 6b);
7. Ground troop clothing for extreme cold weather (see Table 7 and Figures 7a, 7b, 7c, and 7d);
8. Ground troop clothing for extreme cold weather and chemical protection (see Table 8 and Figures 8a and 8b).

The Sample and Measurement Procedure

Five male test subjects were recruited from the US Army Natick Research and Development Center (NRDC) Enlisted Volunteer Platoon. Prior to volunteering for this particular study, the subjects were informed of the purpose of the study, the clothing ensembles they would be asked to wear, and the body dimensions which would be measured. The mean age of the subjects was 23.4 years, the mean weight was 74.4 kg (163.7 lbs), and the mean height was 176.3 cm (69.4 inches). Each of these means is within one standard deviation of the corresponding means for US Army men and US Army armor crewmen as

reported in White and Churchill.⁶ Throughout this report, the published survey data on US Army armor crewmen and on all US Army men (both found in White and Churchill,⁶ 1971 and in MIL-HDBX-759⁴) will be used to represent, respectively, the crew population and the passenger population of the ground combat vehicle. As can be seen in Table 9, the subjects also approximated the percentile range of US Army men and armor crewmen on height and weight.

Twenty-eight anthropometric dimensions were selected for measurement and are defined in the Appendix. These dimensions are illustrated in Figures 9 through 15 and are separated into four categories.

Body Dimensions

1. stature
2. chest depth, standing
3. functional reach, standing
4. vertical arm reach, sitting
5. sitting height
6. eye height, sitting
7. knee height, sitting
8. popliteal height, sitting
9. buttock-knee length, sitting
10. buttock-popliteal length, sitting
11. shoulder breadth, sitting
12. forearm-forearm breadth, sitting
13. hip breadth, sitting

Head Dimensions

14. head breadth
15. head length

Foot Dimensions

16. foot length
17. ball of foot breadth
18. heel breadth

Hand Dimensions

19. hand length
20. palm length
21. hand breadth
22. index finger breadth
23. middle finger breadth
24. grip breadth, inside
25. grip breadth, outside
26. hand clearance around knob, hypothenar (0°)
27. hand clearance around knob, palmar (90°)
28. hand clearance around knob, supinated (180°)

The methods for measuring dimensions 1 through 21 were adapted from White and Churchill's US Army report,⁶ and the methods for measuring dimensions 22 through 28 were adapted from Garrett's US Air Force report.⁷ These measurements are defined in the Appendix and are illustrated in Figures 9-15.

Dimensions were measured in centimeters. Three measurements were obtained for each dimension for each subject and the arithmetic mean was taken as the actual value for each subject. Table 10 presents for each anthropometric dimension the mean value of the sample under a nude condition. The values shown in inches were obtained by dividing each of the values in centimeters by 2.54 (per DARCOM-P-706470, Metric Conversion Guide).⁸ The values presented in Table 10 were compared to body size data for military populations^{6,7} and were found to be representative. On all but five of the 28 dimensions, the sample mean is within one standard deviation of the mean for the corresponding dimension for the military populations. That is, unless stated otherwise in Table 10, each value for dimensions 1 through 21 is within one standard deviation of the mean nude value for all US Army men as well as within one standard deviation of the mean nude value for US Army armor crewmen; the US Army data in White and Churchill⁶ were used to make these comparisons. Since there are no comparable US Army data for dimensions 22 through 28, the US Air Force data presented in Garrett⁷ were used for comparison purposes for these dimensions; accordingly, unless stated otherwise in Table 10, each value for dimensions 22 through 28 is within one standard deviation of the mean nude value for US Air Force men.

Changes in Anthropometric Dimensions Imposed by Clothing

The same 28 anthropometric dimensions measured on each subject while nude were measured on each subject while he was clothed in each of the eight combat clothing ensembles (described in Tables 1 through 8). Measurements made over clothing were conducted with minimal pressure applied to the clothing. Each measuring instrument (e.g., anthropometer) was simply brought into contact with the clothing. No undue pressure was exerted on the clothing which might compress it.

The mean changes in body size imposed by the various clothing ensembles are presented in Tables 11 through 18. The scores presented in these tables were derived for each dimension by subtracting each subject's nude score from his clothed score and then computing a group mean difference score for the sample. As the measurements were made in centimeters, the difference scores were calculated in centimeters. The difference scores which are presented in inches are simply direct conversions from the metric difference scores which are presented in the tables. No sign before a difference score indicates that that dimension increased over the nude measurement as a function of that particular clothing ensemble being worn. A minus sign before a difference score indicates that that measurement decreased as a function of that particular clothing ensemble being worn.

The data in Tables 11 through 18 show that the donning of personal clothing and equipment affect all anthropometric measurements, indicating an increase in the body "envelope" of the soldier. The only measures showing a decrease were those measures of mobility (e.g., vertical arm reach) for which a decrease would mean a restriction of body movement, or those measures (e.g., popliteal height) for which a decrease may actually mean an increase in the body "envelope" of the soldier. The decrease in eye height (sitting) when the subjects are clothed is probably due to a "slump factor" (cf. MIL-HDBK-759,⁴ MIL-STD-1472C³).

Predicted Anthropometric Measurements of the Clothed Soldier

For each garment in each clothing ensemble, the total amount of material (in area) varies as the size of the garment varies to accommodate individuals of differing sizes. However, regardless of the size of the garment, the thickness of the material which makes up the garment remains constant. This means that the difference scores in body dimensions presented in Tables 11 through 18 may be added to corresponding nude body dimensions already published elsewhere (e.g., the nude body dimensions for armor crewmen published in MIL-HDBK-759⁴) in order to yield an estimate of the clothed body measurements of soldiers of varying sizes. This may be done because all the anthropometric dimensions measured in this study are linear. That is, all measurements are straight line distances such as height, breadth, depth, and length. This procedure would not necessarily be valid in the case of curvilinear measurements (such as chest circumference) since the amount of clothing material under the measuring instrument (i.e., a tape measure) varies as garment size varies.

Utilizing this procedure, the predicted anthropometric measurements of the US Army armor crewman and US Army men were generated and are presented in Tables 19 through 34. The data in centimeters are presented in Tables 19 through 26, while the same data in inches are presented in Tables 27 through 34. The predicted clothed body measurements in centimeters were derived by adding the difference scores (in cm) found in Tables 11 through 18 to the corresponding nude body dimensions found in MIL-HDBK-759 (Table XI for US Army armor crewmen and Table IX for US Army men⁴). The predicted clothed body measurements in inches were derived by dividing the metric scores in Tables 19 through 26 by 2.54 (per DARCOM-P-706-470, page 7-18). Therefore, predicted measurements in inches were not obtained by adding the difference scores (in inches) to the nude scores (in inches), but rather a direct conversion was made from the metric predictions of clothed body measurements. The actual mathematical manipulations were performed on the metric data because the raw data (both in this study and those presented in MIL-HDBK-759) were derived from measurements made in centimeters.

DISCUSSION

In general, as one would expect, the data show that body dimensions increase as more and more protective clothing is donned. Specifically, measured body dimensions increase with the donning of hot weather clothing, increase more with the donning of chemical protective clothing, and increase even more with the donning of extreme cold weather clothing. Some dimensions, however, were less susceptible to this trend than others. For example, hand dimensions remained unchanged from the nude to the hot weather troop condition because the hands remained bare. On the other side of the coin, head dimensions gained in size rapidly, even in the hot weather clothing condition, due to the donning of the bulky helmet.

The greatest increase in a body dimension was caused by the donning of the large ALICE pack with frame. Chest depth increased over the nude by an average of 47.1 cm in the hot weather clothing condition, while buttock-knee length increased an average of 39.7 cm. In the cold weather clothing condition, chest depth increased over the nude by 50.9 cm, while buttock-knee length increased 45.6 cm. Such increases in chest depth and buttock-knee length strongly suggest that the wearing of the ALICE pack and frame in a combat vehicle would be a highly inefficient use of space, if not prohibitive. If packs and frames are to be brought on a mission and troops are to be transported in a combat vehicle, packs and frames would probably best be stored in a special compartment, lashed to the exterior of the vehicle, or transported by separate means.

The present data are limited in generality. Only five male soldiers were measured. In order for data such as these to be soundly generalizable to the target populations, data need to be collected on a large number of soldiers, both male and female. Collection of data on clothed body size versus nude body size as one approaches the extreme percentile levels (1st, 5th, 95th, 99th percentiles) will shed light on the validity of the assumption that straight line measures (depth, breadth, height, length, etc.) increase by a constant amount for a particular clothing ensemble regardless of nude body dimension percentile levels.

Lastly, new clothing and personal equipment ensembles may introduce sudden and drastic changes in a body dimension or dimensions (for example, the introduction of a new large pack and frame), and therefore, future data collection on clothed body anthropometry should focus on new clothing and personal equipment ensembles as the Army develops them.

SUMMARY AND CONCLUSIONS

The present report describes an attempt to estimate the types of allowances which must realistically be made for ground combat clothing and personal equipment when worn or carried by the crew and passengers of a ground combat vehicle. Anthropometric data were collected on five nude male soldiers. Anthropometric data were subsequently collected on the same individuals when they were outfitted in each of four ground combat vehicle crewman's clothing ensembles and each of four passenger (ground troop) clothing ensembles. For each body dimension, a difference score was calculated for each soldier to reflect the change in body size as a function of donning each particular clothing ensemble. Mean difference scores were tabulated for each body dimension under each clothing ensemble. Tables of predicted measurements of the clothed body were then generated for each clothing ensemble. Although the present data are limited in generality because all the data were collected on five male soldiers, the tabulated data do give an empirical estimate of the types of allowances in body dimensions which must be made for ground combat clothing and personal equipment. Future research in this area should focus on broadening the subject sample to include females, extremes in body size, and any new clothing and personal equipment items which are introduced in the US Army inventory.

TABLES

TABLE 1

COMBAT VEHICLE CREWMAN'S CLOTHING FOR HOT WEATHER

Body Clothing

Undershirt, Man's (Quarter Sleeve), Cotton; JJ-U-513
Drawers, Cotton; MIL-D-40099
Undergarment, Ballistic Protective; LP/P DES 11-80
Coveralls, Combat Vehicle Crewman's; MIL-C-44077

Headgear

Face Mask, Combat Vehicle Crewman's, Spall, Flame, Dust, Wind Protective;
no specification available
Goggles, Sun, Wind, Dust; MIL-G-43914
Helmet, Combat Vehicle Crewman, DH-132; LP/P. DES 5-78

Footwear

Socks, Men's, Wool, Cushion Sole, Stretch Type; MIL-S-48
Boots, Combat, Leather, Black, Direct Molded Sole; MIL-B-43481E

Handwear

Gloves, Combat Vehicle Crewman's, Summer; LP/P DES 13-78

TABLE 2

COMBAT VEHICLE CREWMAN'S CLOTHING FOR HOT WEATHER AND CHEMICAL PROTECTION

Body Clothing

Undershirt, Man's (Quarter Sleeve), Cotton; JJ-U-513
Drawers, Cotton; MIL-D-40099
Undergarment, Ballistic Protective; LP/P DES 11-80
Coveralls, Combat Vehicle Crewman's; MIL-C-44077
Suit, Chemical Protective (Overgarment), Coat and Trousers; MIL-S-43926

Headgear

Helmet, Combat Vehicle Crewman, DH-132; LP/P. DES 5-78
Mask, Chemical Protective, XM-29; no specification available

Footwear

Socks, Men's, Wool, Cushion Sole, Stretch Type; MIL-S-48
Boots, Combat, Leather, Black, Direct Molded Sole; MIL-B-43481E
Footwear Cover, Chemical Protective (Overboots); MIL-F-43987

Handwear

Gloves, Combat Vehicle Crewman's, Summer; LP/P DES 13-78
Glove Set, Chemical Protective (Butyl Outer Gloves with Cotton Inner
Gloves); MIL-G-43976

TABLE 3

COMBAT VEHICLE CREWMAN'S CLOTHING FOR EXTREME COLD WEATHER

Body Clothing

Undershirt, Cold Weather, Men's; MIL-U-43262
Drawers, Cold Weather, Men's; MIL-D-43261
Undergarment, Ballistic Protective; LP/P DES 11-80
Liner, Coverall, Combat Vehicle Crewman; LP/P DES 12-79
Coveralls, Combat Vehicle Crewman's; MIL-C-44077
Overalls, Combat Vehicle Crewman's; LP/P DES 15-80
Jacket, Cold Weather, High Temperature Resistant; MIL-J-43824

Headgear

Face Mask, Combat Vehicle Crewman's, Spall, Flame, Dust, Wind
Protective; no specification available
Hood, Combat Vehicle Crewman's: Balaclava; LP/P DES 14-80
Helmet, Combat Vehicle Crewman, DH-132; LP/P, DES 5-78
Goggles, Sun, Wind, Dust; MIL-G-4394

Footwear

Socks, Men's, Cushion Sole, Stretch Type; MIL-S-48
Boots, Combat, Leather, Black, Direct Molded Sole; MIL-B-43481E
Overshoes, Vinyl Plastisol; MIL-O-43995

Handwear

Gloves, Combat Vehicle Crewman's, Cold Weather; LP/P DES 9-79

TABLE 4

COMBAT VEHICLE CREWMAN'S CLOTHING FOR EXTREME COLD WEATHER
AND CHEMICAL PROTECTION

Body Clothing

Undershirt, Cold Weather, Men's; MIL-U-43262
Drawers, Cold Weather, Men's; MIL-D-43261
Undergarment, Ballistic Protective; LP/P DES 11-80
Liner, Coverall, Combat Vehicle Crewman; LP/P DES 12-79
Coveralls, Combat Vehicle Crewman's; MIL-C-44077
Overalls, Combat Vehicle Crewman's; LP/P DES 15-80
Jacket, Cold Weather, High Temperature Resistant; MIL-J-43824
Suit, Chemical Protective (Overgarment), Coat and Trousers; MIL-S-43926

Headgear

Hood, Combat Vehicle Crewman's: Balaclava; LP/P DES 14-80
Helmet, Combat Vehicle Crewman, DH-132; LP/P DES 5-78
Mask, Chemical Protective, XM-29; no specification available

Footwear

Socks, Men's, Cushion Sole, Stretch Type; MIL-S-48
Boots, Combat, Leather Black, Direct Molded Sole; MIL-B-43481E
Overshoe, Vinyl Plastisol; MIL-O-43995
Footwear Cover, Chemical Protective (Overboots); MIL-F-43987

Handwear

Glove Set, Chemical Protective (Butyl Outer Gloves with Cotton Inner
Gloves); MIL-G-43976
Gloves, Combat Vehicle Crewman's, Cold Weather; LP/P DES 9-79

TABLE 5

GROUND TROOP CLOTHING FOR HOT WEATHER

Body Clothing

Undershirt, Man's (Quarter Sleeve), Cotton; JJ-U-513
Drawers, Cotton; MIL-D-40099
Coat, Hot Weather, Men's Combat; MIL-C-43199
Trousers, Hot Weather, Man's Combat; MIL-T-43217
Body Armor, Ground Troops, Fragmentation Protective Vest (PASGT);
MIL-B-44053

Headgear

Helmet, Personnel Armor System Ground Troops (PASGT); LP/P DES 12-78A
Cover, Helmet, Ground Troops; LP/P DES 8-79

Footwear

Socks, Men's, Wool, Cushion Sole, Stretch Type; MIL-S-48
Boots, Combat, Leather, Black, Direct Molded Sole; MIL-B-43481E

Handwear

None

Load-Carrying Equipment

Fighting Load, ALICE (All-Purpose Lightweight Individual Carrying Equipment): Belt, Individual Equipment; MIL-B-43826
Suspenders, Individual Equipment; MIL-S-43819
Cases (2), Small Arms Ammunition; MIL-C-43827
Cover, Canteen; MIL-C-43742
Canteen, Water, Plastic With Screw Cap; MIL-C-43103
Cup, Water Canteen, Steel; MIL-C-43761
Intrenching Tool, Hand, Folding, Lightweight and Carrier; MIL-I-43684
Case, First Aid; MIL-C-43745
Large Combat Field Pack With Frame, ALICE (All-Purpose Lightweight Individual Carrying Equipment):
Field Pack, Combat, Nylon, Large; MIL-F-43832
Frame, Pack, Ground Troop, With Straps; MIL-F-43834

TABLE 6

GROUND TROOP CLOTHING FOR HOT WEATHER AND CHEMICAL PROTECTION

Body Clothing

Undershirt Man's (Quarter Sleeve), Cotton; JJ-U-513
Drawers, Cotton; MIL-D-40099
Coat, Hot Weather, Men's Combat; MIL-C-431099
Trousers, Hot Weather, Men's Combat; MIL-T-43217
Body Armor, Ground Troops, Fragmentation Protective Vest (PASGT);
MIL-B-44053
Suit, Chemical Protective (Overgarment), Coat and Trousers; MIL-S-43926

Headgear

Helmet, Personnel Armor System Ground Troops (PASGT); LP/P DES 12-78A
Hood, Helmet Cover, Ground Troops; LP/P DES 8-79
Mask, Chemical Protective, M17A1; MIL-M-51282B
Hood, Chemical Protective, M6a2; MIL-H-51291A(1)

Footwear

Socks, Men's, Wool, Cushion Sole, Stretch Type; MIL-S-48
Boots, Combat, Leather, Black, Direct Molded Sole; MIL-B-43481E
Footwear Cover, Chemical Protective (Overboots); MIL-F-43987

Handwear

Glove Set, Chemical Protective (Butyl Outer Gloves With Cotton Inner
Gloves); MIL-G-43976
Glove Shells, Leather; MIL-G-822

Load-Carrying Equipment

Fighting Load, ALICE (All-Purpose Lightweight Individual Carrying
Equipment):
Belt, Individual Equipment; MIL-B-43826
Suspenders, Individual Equipment; MIL-S-43819
Cases (2), Small Arms Ammunition; MIL-C-43827
Cover, Canteen; MIL-C-43742
Canteen, Water, Plastic With Screw Cap; MIL-C-43103
Cup, Water Canteen, Steel; MIL-C-43761
Intrenching Tool, Hand, Folding, Lightweight and Carrier; MIL-I-43684
Case, First Aid; MIL-C-43745

TABLE 7

GROUND TROOP CLOTHING FOR EXTREME COLD WEATHER

Body Clothing

Undershirt, Cold Weather, Men's; MUL-U-43262
Drawers, Cold Weather, Mens; MIL-D-43261
Shirt, Wool; MIL-S-10858
Body Armor, Ground Troops, Fragmentation Protective Vest (PASGT);
MIL-B-44053
Liner, Coat; MIL-L-43536
Coat, Field; MIL-C-43455
Liner, Parka; MIL-L-43466
Parka, Extreme Cold Weather; MIL-P-43496
Liner, Field Trouser; MIL-L-43498
Trousers, Field; MIL-T-43497
Liner, Arctic Trouser; MIL-L-43672
Trouser, Arctic; MIL-T-43654
Suspenders; MIL-S-10926

Headgear

Cap, Insulating Helmet Liner; MIL-C-43549
Helmet, Personnel Armor System Ground Troops (PASGT); LP/P DES 12-78A
Cover, Helmet, Ground Troops; LP/P DES 8-79
Hood, Extreme Cold Weather, With Fur Ruff, OG-107; MIL-H-43555

Footwear

Socks, Men's, Cushion Sole, Stretch Type; MIL-S-48
Boot, Insulated, White; MIL-B-41816

Handwear

Mitten Inserts, Wool/Nylon; MIL-M-809
Mitten Set, Extreme Cold Weather; MIL-M-82

Load-Carrying Equipment

Fighting load, ALICE (All-Purpose Lightweight Individual Carrying Equipment):
Belt, Individual Equipment; MIL-B-43826
Suspenders, Individual Equipment; MIL-S-43819
Cases (2), Small Arms Ammunition; MIL-C-43827
Cover, Canteen; MIL-C-43742
Canteen, Water, Plastic With Screw Cap; MIL-C-43103
Cup, Water Canteen, Steel; MIL-C-43761
Intrenching Tool, Hand, Folding, Lightweight and Carrier; MIL-I-43684
Case, First Aid; MIL-C-43745

TABLE 7

GROUND TROOP CLOTHING FOR EXTREME COLD WEATER (cont'd)

Large Combat Field Pack With Frame, ALICE (All-Purpose Lightweight Individual Carrying Equipment):

Field Pack, Combat, Nylon, Large; MIL-F-43832

Frame, Pack, Ground Troop, With Straps; MIL-F-43834

TABLE 8

GROUND TROOP CLOTHING FOR EXTREME COLD WEATHER
AND CHEMICAL PROTECTION

Body Clothing

Undershirt, Cold Weather, Men's; MIL-U-43262
Drawers, Cold Weather, Men's; MIL-D-43261
Shirt, Wool; MIL-S-10858
Body Armor, Ground Troops, Fragmentation Protective Vest (PASGT);
MIL-B-44053
Liner, Coat; MIL-L-43536
Coat, Field; MIL-C-43455
Liner, Parka; MIL-L-43466
Parka, Extreme Cold Weather; MIL-P-43496
Liner, Field Trouser; MIL-L-43498
Trousers, Field; MIL-T-43497
Liner, Arctic Trouser; MIL-L-43672
Trousers, Arctic; MIL-T-43654
Suspenders; MIL-S-10926
Suit, Chemical Protective (Overgarment), Coat and Trouser; MIL-S-43926

Headgear

Mask, Chemical Protective, M17A1; MIL-M-51282B
Hood, Chemical Protective, M6a2; MIL-H-51291A(1)
Helmet, Personnel Armor System Ground Troops (PASGT); LP/P DES 12-78A
Cover, Helmet, Ground Troops; LP/P DES 8-79
Hood, Extreme Cold Weather, With Fur Ruff, OG-107; MIL-H-43555

Footwear

Socks, Men's, Cushion sole, Stretch Type; MIL-S-48
Boot, Insulated, White; MIL-B-41816
Footwear Cover, Chemical Protective (Overboots); MIL-F-43987

Handwear

Glove Set, Chemical Protective (Butyl Outer Gloves With Cotton Inner
Gloves); MIL-G-43976
Glove Shells, Leather; MIL-G-822
Mitten Set, Extreme Cold Weather; MIL-M-825

TABLE 8

GROUND TROOP CLOTHING FOR EXTREME COLD WEATHER
AND CHEMICAL PROTECTION (cont'd)

Load-Carrying Equipment

Fighting Load, ALICE (All-Purpose Lightweight Individual Carrying Equipment):

Belt, Individual Equipment; MIL-B-43826

Suspenders, Individual Equipment; MIL-S-43819

Cases (2), Small Arms Ammunition; MIL-C-43827

Cover, Canteen; MIL-C-43742

Canteen, Water, Plastic With Screw Cap; MIL-C-43103

Cup, Water Canteen, Steel; MIL-C-43761

Intrenching Tool, Hand, Folding, Lightweight and Carrier; MIL-I-43684

Case, First Aid; MIL-C-43745

TABLE 9. Each Subject's Percentile Rankings Based On Stature And On Weight For Two Reference Populations.

TEST SUBJECT (stature, weight)	Percentile Ranking Based on <u>STATURE</u>		Percentile Ranking Based on <u>WEIGHT</u>	
	All Army Men	Army Armor Crewmen	All Army Men	Army Armor Crewmen
A. (188.9 cm, 98.6 kg)	99	99	98	95
B. (183.0 cm, 77.7 kg)	90	90	75	50
C. (176.3 cm, 72.7 kg)	50	50	50	50
D. (169.1 cm, 62.3 kg)	25	25	10	10
E. (164.2 cm, 60.9 kg)	5	5	10	10

Note: MIL-HDBK 759 (Tables IX and XI) was used for calculating the nearest percentile ranking.

TABLE 10. Mean Values Of The Male Soldier Sample For Each Anthropometric Dimension, N=5.

<u>Body Dimensions</u>	<u>MEAN VALUE (NUDE)</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	69.4	176.3
2. chest depth, standing	8.9	22.7
3. functional reach, standing	33.5	85.2
4. vertical arm reach, sitting	55.0	139.6
5. sitting height	35.2	89.5
6. eye height, sitting	30.8	78.3
7. knee height, sitting	22.3	56.6
8. popliteal height, sitting	17.8	45.2
9. buttock-knee length, sitting	24.1	61.2
10. buttock-popliteal length, sitting	19.9	50.6
11. shoulder breadth, sitting	18.7	47.5
12. forearm-forearm breadth, sitting	18.3	46.4
13. hip breadth, sitting	14.2	36.1
<u>Head Dimensions</u>		
14. head breadth	6.2	15.7
15. head length 1,2	7.2	18.2
<u>Foot Dimensions</u>		
16. foot length	10.9	27.7
17. ball of foot breadth	4.1	10.3
18. heel breadth	2.6	6.7
<u>Hand Dimensions</u>		
19. hand length ¹	7.9	20.1
20. palm length ^{1,2}	4.5	11.5
21. hand breadth ¹	3.7	9.4
22. index finger breadth	0.8	2.1
23. middle finger breadth	0.8	2.1
24. grip breadth, inside ³	2.1	5.4
25. grip breadth, outside	4.2	10.6
26. hand clearance around knob, hypothenar	2.9	7.4
27. hand clearance around knob, palmar	1.6	4.0
28. hand clearance around knob, supinated	3.9	9.9

¹This mean nude value is more than one standard deviation from the mean nude value for all US Army men.⁶

²This mean nude value is more than one standard deviation from the mean nude value for US Army armor crewmen.⁶

³This mean nude value is more than one standard deviation from the mean nude value for US Air Force men.⁷

TABLE 11. Mean Changes In Anthropometric Measurements Imposed By Combat Vehicle Crewmen's Clothing For Hot Weather.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	2.3	5.8
2. chest depth, standing	1.5	3.8
3. functional reach, standing	0.4	1.1
4. vertical arm reach, sitting	-1.1	-2.7
5. sitting height	1.1	2.8
6. eye height, sitting	-0.4	-1.1
7. knee height, sitting	1.2	3.1
8. popliteal height, sitting	1.1	2.9
9. buttock-knee length, sitting	0.5	1.2
10. buttock-popliteal length, sitting	0.2	0.6
11. shoulder breadth, sitting	0.1	0.2
12. forearm-forearm breadth, sitting	1.9	4.7
13. hip breadth, sitting	0.9	2.3
<u>Head Dimensions</u>		
14. head breadth	5.5	14.0
15. head length	3.5	8.8
<u>Foot Dimensions</u>		
16. foot length	1.3	3.4
17. ball of foot breadth	0.4	1.1
18. heel breadth	0.7	1.7
<u>Hand Dimensions</u>		
19. hand length	0.1	0.3
20. palm length	0.0	0.0
21. hand breadth	0.1	0.3
22. index finger breadth	0.1	0.3
23. middle finger breadth	0.1	0.2
24. grip breadth, inside	-0.1	-0.2
25. grip breadth, outside	0.0	0.0
26. hand clearance around knob, hypothenar	0.1	0.3
27. hand clearance around knob, palmar	0.0	0.1
28. hand clearance around knob, supinated	0.4	1.0

TABLE 12. Mean Changes In Anthropometric Measurements Imposed By Combat Vehicle Crewman's Clothing For Hot Weather And Chemical Protection.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	2.4	6.2
2. chest depth, standing	2.6	6.5
3. functional reach, standing	0.1	0.3
4. vertical arm reach, sitting	-1.9	-4.9
5. sitting height	1.1	2.7
6. eye height, sitting	-0.5	-1.2
7. knee height, sitting	1.4	3.6
8. popliteal height, sitting	0.8	2.0
9. buttock-knee length, sitting	1.1	2.7
10. buttock-popliteal length, sitting	-0.5	-1.2
11. shoulder breadth, sitting	3.7	7.3
12. forearm-forearm breadth, sitting	5.6	14.3
13. hip breadth, sitting	2.8	7.0
<u>Head Dimensions</u>		
14. head breadth	5.6	14.1
15. head length	3.0	7.5
<u>Foot Dimensions</u>		
16. foot length	3.2	8.2
17. ball of foot breadth	2.3	5.8
18. heel breadth	2.3	5.8
<u>Hand Dimensions</u>		
19. hand length	0.2	0.6
20. palm length	0.3	0.7
21. hand breadth	0.4	1.0
22. index finger breadth	0.2	0.4
23. middle finger breadth	0.2	0.4
24. grip breadth, inside	-0.3	-0.7
25. grip breadth, outside	0.0	0.1
26. hand clearance around knob, hypothenar	0.5	1.2
27. hand clearance around knob, palmar	0.4	1.1
28. hand clearance around knob, supinated	0.6	1.4

TABLE 13. Mean Changes In Anthropometric Measurements Imposed By Combat Vehicle Crewman's Clothing For Extreme Cold Weather.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	2.8	7.1
2. chest depth, standing	3.0	7.5
3. functional reach, standing	-0.4	-0.9
4. vertical arm reach, sitting	-7.2	-18.4
5. sitting height	1.5	3.8
6. eye height, sitting	-0.4	-1.1
7. knee height, sitting	1.6	4.0
8. popliteal height, sitting	-0.4	-0.9
9. buttock-knee length, sitting	1.2	3.1
10. buttock-popliteal length, sitting	-1.6	-4.1
11. shoulder breadth, sitting	2.7	8.9
12. forearm-forearm breadth, sitting	6.4	16.3
13. hip breadth, sitting	3.0	7.7
<u>Head Dimensions</u>		
14. head breadth	5.6	14.3
15. head length	3.8	9.6
<u>Foot Dimensions</u>		
16. foot length	1.8	4.5
17. ball of foot breadth	0.9	2.4
18. heel breadth	1.1	2.8
<u>Hand Dimensions</u>		
19. hand length	0.3	0.8
20. palm length	0.3	0.8
21. hand breadth	0.4	0.9
22. index finger breadth	0.2	0.5
23. middle finger breadth	0.2	0.4
24. grip breadth, inside	-0.2	-0.6
25. grip breadth, outside	0.1	0.3
26. hand clearance around knob, hypothenar	0.5	1.2
27. hand clearance around knob, palmar	0.2	0.4
28. hand clearance around knob, supinated	0.7	1.7

TABLE 14. Mean Changes In Anthropometric Measurements Imposed By Combat Vehicle Crewman's Clothing For Extreme Cold Weather And Chemical Protection.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	2.9	7.4
2. chest depth, standing	5.0	12.7
3. functional reach, standing	0.3	0.8
4. vertical arm reach, sitting	-8.5	-21.7
5. sitting height	1.7	4.2
6. eye height, sitting	-0.7	-1.9
7. knee height, sitting	1.9	4.9
8. popliteal height, sitting	-0.4	-1.1
9. buttock-knee length, sitting	2.1	5.4
10. buttock-popliteal length, sitting	-0.8	-2.0
11. shoulder breadth, sitting	4.2	10.7
12. forearm-forearm breadth, sitting	8.6	21.9
13. hip breadth, sitting	4.6	11.7
<u>Head Dimensions</u>		
14. head breadth	5.8	14.8
15. head length	3.1	8.0
<u>Foot Dimensions</u>		
16. foot length	3.9	9.8
17. ball of foot breadth	2.6	6.6
18. heel breadth	2.4	6.0
<u>Hand Dimensions</u>		
19. hand length	0.4	1.0
20. palm breadth	0.9	2.2
21. hand breadth	0.6	1.4
22. index finger breadth	0.3	0.8
23. middle finger breadth	0.3	0.7
24. grip breadth, inside	-0.4	-1.1
25. grip breadth, outside	0.0	0.1
26. hand clearance around knob, hypothenar	0.7	1.8
27. hand clearance around knob, palmar	0.3	0.7
28. hand clearance around knob, supinated	0.8	2.0

TABLE 15. Mean Changes In Anthropometric Measurements Imposed By Ground Troop Clothing For Hot Weather.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	1.9	4.7
2. chest depth, standing	2.6(18.5)	6.5(47.1)
3. functional reach, standing	0.7(15.3)	1.7(38.8)
4. vertical arm reach, sitting	-2.6(-3.9)	-6.6(-9.9)
5. sitting height	0.7	1.9
6. eye height, sitting	-0.5	-1.2
7. knee height, sitting	1.3	3.4
8. popliteal height, sitting	1.0	2.5
9. buttock-knee length, sitting	1.9(15.6)	4.7(39.7)
10. buttock-popliteal length, sitting	1.2(15.8)	3.1(40.2)
11. shoulder breadth, sitting	0.6	1.5
12. forearm-forearm breadth, sitting	5.1	13.0
13. hip breadth, sitting	5.6	14.3
<u>Head Dimensions</u>		
14. head breadth	3.5	8.8
15. head length	3.5	9.0
<u>Foot Dimensions</u>		
16. foot length	1.3	3.4
17. ball of foot breadth	0.4	1.1
18. heel breadth	0.7	1.7
<u>Hand Dimensions</u>		
19. hand length	0.0	0.0
20. palm length	0.0	0.0
21. hand breadth	0.0	0.0
22. index finger breadth	0.0	0.0
23. middle finger breadth	0.0	0.0
24. grip breadth, inside	0.0	0.0
25. grip breadth, outside	0.0	0.0
26. hand clearance around knob, hypothenar	0.0	0.0
27. hand clearance around knob, palmar	0.0	0.0
28. hand clearance around knob, supinated	0.0	0.0

NOTE: Scores in parentheses indicate difference from nude measurement when the large ALICE pack with frame (LC-1) is worn.

TABLE 16. Mean Changes In Anthropometric Measurements Imposed By Ground Troop Clothing For Hot Weather And Chemical Protection.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	2.6	6.5
2. chest depth, standing	3.6	9.1
3. functional reach, standing	0.3	0.8
4. vertical arm reach, sitting	-3.6	-9.1
5. sitting height	1.1	2.7
6. eye height, sitting	-0.6	-1.6
7. knee height, sitting	1.7	4.3
8. popliteal height, sitting	0.7	1.7
9. buttock-knee length, sitting	1.5	3.9
10. buttock-popliteal length, sitting	0.4	1.0
11. shoulder breadth, sitting	2.6	6.6
12. forearm-forearm breadth, sitting	8.0	20.2
13. hip breadth, sitting	6.6	16.7
<u>Head Dimensions</u>		
14. head breadth	3.5	8.8
15. head length	3.5	9.0
<u>Foot Dimensions</u>		
16. foot length	3.3	8.4
17. ball of foot length	2.3	5.8
18. heel breadth	1.7	4.3
<u>Hand Dimensions</u>		
19. hand length	0.0[0.3]	0.0[0.7]
20. palm length	0.3[0.6]	0.8[1.5]
21. hand breadth	0.2[0.4]	0.5[1.1]
22. index finger breadth	0.1[0.2]	0.2[0.6]
23. middle finger breadth	0.1[0.2]	0.2[0.6]
24. grip breadth, inside	-0.1[-0.3]	-0.3[-0.7]
25. grip breadth, outside	0.0[0.1]	0.1[0.3]
26. hand clearance around knob, hypothenar	0.2[1.0]	0.6[2.5]
27. hand clearance around knob, palmar	0.1[0.6]	0.3[1.4]
28. hand clearance around knob, supinated	0.4[0.9]	1.0[2.3]

NOTE: Scores in brackets indicate difference from nude measurement when the black leather glove shells are worn over the CB Gloves.

TABLE 17. Mean Changes In Anthropometric Measurements Imposed By Ground Troop Clothing For Extreme Cold Weather.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	3.0	7.5
2. chest depth, standing	5.0(20.0)	12.6(50.9)
3. functional reach, standing	2.7(15.7)	6.9(39.8)
4. vertical arm reach, sitting	-8.3(-8.8)	-21.1(-22.3)
5. sitting height	1.8	4.6
6. eye height, sitting	-0.2	-0.5
7. knee height, sitting	1.6	4.1
8. popliteal height, sitting	0.2	0.6
9. buttock-knee length, sitting	2.6(18.0)	6.7(45.6)
10. buttock-popliteal length, sitting	1.9(17.2)	4.7(43.7)
11. shoulder breadth, sitting	4.9	12.5
12. forearm-forearm breadth, sitting	10.6	27.0
13. hip breadth, sitting	7.2	18.2
<u>Head Dimensions</u>		
14. head breadth	5.4	13.7
15. head length	4.8	12.3
<u>Foot Dimensions</u>		
16. foot length	2.5	6.4
17. ball of foot breadth	1.2	3.0
18. heel breadth	1.4	3.6
<u>Hand Dimensions</u>		
19. hand length	0.9[0.0]	2.4[0.1]
20. palm length	NA[0.1]	NA[0.2]
21. hand breadth	1.2[0.3]	3.0[0.7]
22. index finger breadth	NA[0.2]	NA[0.4]
23. middle finger breadth	NA[NA]	NA[NA]
24. grip breadth, inside	-0.6[-0.2]	-1.5[-0.6]
25. grip breadth, outside	0.2[0.0]	0.6[0.1]
26. hand clearance around knob, hypothenar	1.2[0.5]	3.1[1.2]
27. hand clearance around knob, palmar	1.8[0.3]	4.6[0.7]
28. hand clearance around knob, supinated	2.0[0.7]	5.0[1.7]

NOTE: Scores in parentheses indicate difference from nude measurement when the large ALICE pack with frame (LC-1) is worn. Scores in brackets indicate difference from nude measurement when only the trigger-finger inserts are worn.

TABLE 18. Mean Changes In Anthropometric Measurements Imposed By Ground Troop Clothing For Extreme Cold Weather And Chemical Protection.

<u>Body Dimensions</u>	<u>Difference from Nude Measurement</u>	
	<u>Inches</u>	<u>Centimeters</u>
1. stature	3.5	8.9
2. chest depth, standing	6.1	15.6
3. functional reach, standing	1.7	4.3
4. vertical arm reach, sitting	-9.5	-24.1
5. sitting height	2.4	6.0
6. eye height, sitting	-0.7	-1.9
7. knee height, sitting	2.3	5.8
8. popliteal height, sitting	0.6	1.6
9. buttock-knee length, sitting	3.3	8.5
10. buttock-popliteal length, sitting	0.9	2.2
11. shoulder breadth, sitting	5.9	15.0
12. forearm-forearm breadth, sitting	12.5	31.7
13. hip breadth, sitting	8.9	22.6
<u>Head Dimensions</u>		
14. head breadth	5.8	14.8
15. head length	6.0	15.3
<u>Foot Dimensions</u>		
16. foot length	4.6	11.7
17. ball of foot breadth	2.5	6.3
18. heel breadth	1.5	3.7
<u>Hand Dimensions</u>		
19. hand length	0.6[0.8]	1.4[2.1]
20. palm length	NA[NA]	NA[NA]
21. hand breadth	1.0[1.3]	2.6[3.4]
22. index finger breadth	NA[NA]	NA[NA]
23. middle finger breadth	NA[NA]	NA[NA]
24. grip breadth, inside	-0.5[-0.7]	-1.2[-1.8]
25. grip breadth, outside	0.2[0.2]	0.5[0.4]
26. hand clearance around knob, hypothenar	1.2[1.2]	3.1[3.1]
27. hand clearance around knob, palmar	2.3[2.5]	5.8[6.3]
28. hand clearance around knob, supinated	1.9[1.9]	4.7[4.9]

NOTE: Scores in brackets indicate difference from nude measurement when the black leather glove shells are worn over the CB Gloves and under the arctic mittens.

TABLE 19. Predicted Anthropometric Measurements (In Centimeters) Of The
US Army Armor Crewman Dressed For Hot Weather.

Body Dimensions	Percentile				
	1st	5th	50th	95th	99th
1. stature	165.4	169.2	180.2	191.2	195.0
2. chest depth, standing	23.4	24.7	27.6	31.8	34.0
3. functional reach, standing	73.1	76.2	84.0	92.7	95.9
4. vertical arm reach, sitting	122.7	126.1	135.7	145.2	151.1
5. sitting height	84.2	86.5	93.0	99.5	102.4
6. eye height, sitting	68.4	70.8	77.2	83.2	86.3
7. knee height, sitting	50.1	52.7	57.3	61.9	63.5
8. popliteal height, sitting	42.3	43.7	47.3	51.7	53.2
9. buttock-knee length, sitting	54.3	56.2	60.9	66.2	68.8
10. buttock-popliteal length, sitting	45.4	46.8	50.7	55.0	57.3
11. shoulder breadth, sitting	40.4	42.3	46.0	51.4	53.4
12. forearm-forearm breadth, sitting	42.9	44.9	51.6	60.3	65.1
13. hip breadth, sitting	32.3	33.2	36.6	41.6	43.6
<u>Head Dimensions</u>					
14. head breadth	27.9	28.4	29.3	30.3	30.8
15. head length	26.6	27.1	28.4	29.6	30.0
<u>Foot Dimensions</u>					
16. foot length	27.1	28.1	30.2	32.6	33.4
17. ball of foot breadth	9.6	10.1	10.9	11.8	12.3
18. heel breadth	7.7	7.9	8.6	9.6	10.1
<u>Hand Dimensions</u>					
19. hand length	17.1	17.7	19.4	21.1	22.2
20. palm length	9.0	9.5	10.6	11.7	12.2
21. hand breadth	8.1	8.4	9.2	10.0	10.5
22. index finger breadth		2.2	2.4	2.6	
23. middle finger breadth		2.1	2.3	2.5	
24. grip breadth, inside		4.1	4.7	5.4	
25. grip breadth, outside		9.3	10.7	11.8	
26. hand clearance around knob, hypothenar		4.7	6.9	8.9	
27. hand clearance around knob, palmar		3.2	3.9	5.4	
28. hand clearance around knob, supinated		9.5	11.2	12.1	

TABLE 20. Predicted Anthropometric Measurements (In Centimeters) Of The US Army Armor Crewman Dressed For Hot Weather And Chemical Protection.

Body Dimensions	Percentile				
	1st	5th	50th	95th	99th
1. stature	165.8	169.6	180.6	191.6	195.4
2. chest depth, standing	26.1	27.4	30.3	34.5	36.7
3. functional reach, standing	73.3	75.4	83.2	91.9	95.1
4. vertical arm reach, sitting	120.5	123.9	133.5	143.0	148.9
5. sitting height	84.1	86.4	92.9	99.4	102.3
6. eye height, sitting	68.3	70.7	77.1	83.1	86.2
7. knee height, sitting	50.6	53.2	57.8	62.4	64.0
8. popliteal height, sitting	41.4	42.8	46.4	50.8	52.3
9. buttock-knee length, sitting	55.8	57.7	62.4	67.7	70.3
10. buttock-popliteal length, sitting	43.6	45.0	48.9	53.2	55.5
11. shoulder breadth, sitting	47.5	49.4	53.1	58.5	60.5
12. forearm-forearm breadth, sitting	52.5	54.5	61.2	69.9	74.7
13. hip breadth, sitting	37.0	37.9	41.3	46.3	48.3
<u>Head Dimensions</u>					
14. head breadth	28.0	28.5	29.4	30.4	30.9
15. head length	25.3	25.8	27.1	28.3	28.7
<u>Foot Dimensions</u>					
16. foot length	31.9	32.9	35.0	37.4	38.2
17. ball of foot breadth	14.3	14.8	15.6	16.5	17.0
18. heel breadth	11.8	12.0	12.7	13.7	14.2
<u>Hand Dimensions</u>					
19. hand length	17.4	18.0	19.7	21.4	22.5
20. palm length	9.7	10.2	11.3	12.4	12.9
21. hand breadth	8.8	9.1	9.9	10.7	11.2
22. index finger breadth		2.3	2.5	2.7	
23. middle finger breadth		2.3	2.5	2.7	
24. grip breadth, inside		3.6	4.2	4.9	
25. grip breadth, outside		9.4	10.8	11.9	
26. hand clearance around knob, hypothenar		5.6	8.0	9.8	
27. hand clearance around knob, palmar		4.2	4.9	6.4	
28. hand clearance around knob, supinated		9.9	11.7	12.5	

TABLE 21. Predicted Anthropometric Measurements (In Centimeters) Of The US Army Armor Crewman Dressed For Extreme Cold Weather.

Body Dimensions	Percentile				
	1st	5th	50th	95th	99th
1. stature	166.7	170.5	181.5	192.5	196.3
2. chest depth, standing	27.1	28.4	31.3	35.5	37.7
3. functional reach, standing	71.1	74.2	82.0	90.7	93.9
4. vertical arm reach, sitting	107.0	110.4	120.0	129.5	135.4
5. sitting height	85.2	87.5	94.0	100.5	103.4
6. eye height, sitting	68.4	70.8	77.2	83.2	86.3
7. knee height, sitting	51.0	53.6	58.2	62.8	64.4
8. popliteal height, sitting	38.5	39.9	43.5	47.9	49.4
9. buttock-knee length, sitting	56.2	58.1	62.8	68.1	70.7
10. buttock-popliteal length, sitting	40.7	42.1	46.0	50.3	52.6
11. shoulder breadth, sitting	49.1	51.0	54.7	60.1	62.1
12. forearm-forearm breadth, sitting	54.5	56.5	63.2	71.9	76.7
13. hip breadth, sitting	37.7	38.6	42.0	47.0	49.0
<u>Head Dimensions</u>					
14. head breadth	28.2	28.7	29.6	30.6	31.1
15. head length	27.4	27.9	29.2	30.4	30.8
<u>Foot Dimensions</u>					
16. foot length	28.2	29.2	31.3	33.7	34.5
17. ball of foot breadth	10.9	11.4	12.2	13.1	13.6
18. heel breadth	8.8	9.0	9.7	10.7	11.2
<u>Hand Dimensions</u>					
19. hand length	17.6	18.2	19.9	21.6	22.7
20. palm length	9.8	10.3	11.4	12.5	13.0
21. hand breadth	8.7	9.0	9.8	10.6	11.1
22. index finger breadth		2.4	2.6	2.8	
23. middle finger breadth		2.3	2.5	2.7	
24. grip breadth, inside		3.7	4.3	5.0	
25. grip breadth, outside		9.6	11.0	12.1	
26. hand clearance around knob, hypothenar		5.6	8.0	9.8	
27. hand clearance around knob, palmar		3.5	4.2	5.7	
28. hand clearance around knob, supinated		10.2	12.0	12.8	

TABLE 22. Predicted Anthropometric Measurements (In Centimeters) Of The US Army Armor Crewman Dressed For Extreme Cold Weather And Chemical Protection.

Body Dimensions		Percentile				
		1st	5th	50th	95th	99th
1.	stature	167.0	170.8	181.8	192.8	196.6
2.	chest depth, standing	32.3	33.6	36.5	40.7	42.9
3.	functional reach, standing	72.8	75.9	83.7	92.4	95.6
4.	vertical arm reach, sitting	103.7	107.1	116.7	126.2	132.1
5.	sitting height	85.6	87.9	94.4	100.9	103.8
6.	eye height, sitting	67.6	70.0	76.4	82.4	85.5
7.	knee height, sitting	51.9	54.5	59.1	63.7	65.3
8.	popliteal height, sitting	38.3	39.7	43.3	47.7	49.2
9.	buttock-knee length, sitting	58.5	60.4	65.1	70.4	73.0
10.	buttock-popliteal length, sitting	42.8	44.2	48.1	52.4	54.7
11.	shoulder breadth, sitting	50.9	52.8	56.5	61.9	63.9
12.	forearm-forearm breadth, sitting	67.9	70.1	76.8	85.5	90.3
13.	hip breadth, sitting	41.7	42.6	46.0	51.0	53.0
<u>Head Dimensions</u>						
14.	head breadth	28.7	29.2	30.1	31.1	31.6
15.	head length	25.8	26.3	27.6	28.8	29.2
<u>Foot Dimensions</u>						
16.	foot length	33.5	34.5	36.6	39.0	39.8
17.	ball of foot breadth	15.1	15.6	16.4	17.3	17.8
18.	heel breadth	12.0	12.2	12.9	13.9	14.4
<u>Hand Dimensions</u>						
19.	hand length	17.8	18.4	20.1	21.8	22.9
20.	palm length	11.2	11.7	12.8	13.9	14.4
21.	hand breadth	9.2	9.5	10.3	11.1	11.6
22.	index finger breadth		2.7	2.9	3.1	
23.	middle finger breadth		2.6	2.8	3.0	
24.	grip breadth, inside		3.2	3.8	4.5	
25.	grip breadth, outside		9.4	10.8	11.9	
26.	hand clearance around knob, hypothenar		6.2	8.6	10.4	
27.	hand clearance around knob, palmar		3.8	4.5	6.0	
28.	hand clearance around knob, supinated		10.5	12.3	13.1	

TABLE 23. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather

Percentile

<u>Body Dimensions</u>		<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature		163.6	168.5	179.1	190.3	195.0
2. chest depth, standing		25.7(66.3)	26.7(67.3)	29.5(70.1)	33.2(73.8)	35.3(75.9)
3. functional reach, standing		73.6(110.7)	76.6(113.7)	84.1(121.2)	92.6(129.7)	96.3(133.4)
4. vertical arm reach, sitting		118.1(114.8)	122.1(118.8)	131.6(128.3)	141.2(137.9)	146.0(142.7)
5. sitting height		83.9	86.4	92.7	98.6	101.1
6. eye height, sitting		68.9	71.6	77.6	83.4	85.8
7. knee height, sitting		51.1	53.1	57.4	62.1	64.0
8. popliteal height, sitting		41.3	43.1	47.0	51.3	52.9
9. buttock-knee length, sitting		57.6(92.6)	59.6(94.6)	64.1(99.1)	69.0(104.0)	71.2(106.2)
10. buttock-popliteal length, sitting		47.1(84.2)	48.9 (86.0)	52.9(90.0)	57.1(94.2)	58.9(96.0)
11. shoulder breadth, sitting		41.5	43.0	46.7	51.3	53.6
12. forearm-forearm breadth, sitting		50.9	52.8	58.6	66.6	70.6
13. hip breadth, sitting		43.8	45.0	48.2	52.7	55.0
<u>Head Dimensions</u>						
14. head breadth		22.7	23.1	24.1	25.1	25.5
15. head length		26.8	27.3	28.5	29.7	30.2
<u>Foot Dimensions</u>						
16. foot length		27.2	28.1	30.1	32.4	33.4
17. ball of foot breadth		9.7	10.1	10.9	11.9	12.3
18. heel breadth		7.6	7.9	8.5	9.4	9.8

TABLE 23. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather (Cont'd)

<u>Hand Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
19. hand length	16.9	17.5	19.0	20.7	21.4
20. palm length	9.2	9.6	10.6	11.7	12.2
21. hand breadth	7.8	8.1	8.9	9.7	10.1
22. index finger breadth		1.9	2.1	2.3	
23. middle finger breadth		1.9	2.1	2.3	
24. grip breadth, inside		4.3	4.9	5.6	
25. grip breadth, outside		9.3	10.7	11.8	
26. hand clearance around knob, hypothenar		4.4	6.8	8.6	
27. hand clearance around knob, palmar		3.1	3.8	5.3	
28. hand clearance around knob, supinated		8.5	10.3	11.1	

NOTE: Scores in parentheses indicate the predicted measurement when the large ALICE pack with frame (LC-1) is worn.

TABLE 24. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather and
Chemical Protection

Percentile

<u>Body Dimensions</u>		<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature		165.4	170.3	180.9	192.1	196.8
2. chest depth, standing		28.3	29.3	32.1	35.8	37.9
3. functional reach, standing		72.7	75.7	83.2	91.7	95.4
4. vertical arm reach, sitting		115.6	119.6	129.1	138.7	143.5
5. sitting height		84.7	87.2	93.5	99.4	101.9
6. eye height, sitting		68.5	71.2	77.2	83.0	85.4
7. knee height, sitting		52.0	54.0	58.3	63.0	64.9
8. popliteal height, sitting		40.5	42.3	46.2	50.5	52.1
9. buttock-knee length, sitting		56.8	58.8	63.3	68.2	70.4
10. buttock-popliteal length, sitting		45.0	46.8	50.8	55.0	56.8
11. shoulder breadth, sitting		46.6	48.1	51.8	56.4	58.7
12. forearm-forearm breadth, sitting		58.1	60.0	65.8	73.8	77.8
13. hip breadth, sitting		46.2	47.4	50.6	55.1	57.4
<u>Head Dimensions</u>						
14. head breadth		22.7	23.1	24.1	25.1	25.5
15. head length		26.8	27.3	28.5	29.7	30.1
<u>Foot Dimensions</u>						
16. foot length		32.2	33.1	35.1	37.4	38.4
17. ball of foot breadth		14.4	14.8	15.6	16.6	17.0
18. heel breadth		10.2	10.5	11.1	12.0	12.4

TABLE 24. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather and
Chemical Production (cont'd)

Hand Dimensions	Percentile				
	1st	5th	50th	95th	99th
19. hand length	16.9[17.6]	17.5[18.2]	19.0[19.7]	20.7[21.4]	21.4[22.1]
20. palm length	10.0[10.7]	10.4[11.1]	11.4[12.1]	12.5[13.2]	13.0[13.7]
21. hand breadth	8.3[8.9]	8.6[9.2]	9.4[10.0]	10.2[10.8]	10.6[11.2]
22. index finger breadth		2.1[2.5]	2.3[2.7]	2.5[2.9]	
23. middle finger breadth		2.1[2.5]	2.3[2.7]	2.5[2.9]	
24. grip breadth, inside		4.0[3.6]	4.6[4.2]	5.3[4.8]	
25. grip breadth, outside		9.4[9.6]	10.8[11.0]	11.9[12.1]	
26. hand clearance around knob, hypothenar		5.0[6.9]	7.4[9.3]	9.2[11.1]	
27. hand clearance around knob, palmar		3.4[4.5]	4.1[5.2]	5.6[6.7]	
28. hand clearance around knob, supinated		9.5[10.8]	11.3[12.6]	12.1[13.4]	

NOTE: Scores in brackets indicate the predicted measurement when the black leather glove shells are worn over the CB glo

TABLE 25. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather

		Percentile				
		1st	5th	50th	95th	99th
<u>Body Dimensions</u>						
1. stature		166.4	171.3	181.9	193.1	197.8
2. chest depth, standing		31.8(70.1)	32.8(71.1)	35.6(73.9)	39.3(77.6)	41.4(79.7)
3. functional reach, standing		78.8(111.7)	81.8(114.7)	89.3(122.2)	97.8(130.7)	101.5(134.4)
4. vertical arm reach, sitting		103.6(102.4)	107.6(106.4)	117.1(115.9)	126.7(125.5)	131.5(130.3)
5. sitting height		86.6	89.1	95.4	101.3	103.8
6. eye height, sitting		69.6	72.3	78.3	84.1	86.5
7. knee height, sitting		51.8	53.8	58.1	62.8	64.7
8. popliteal height, sitting		39.4	41.2	45.1	49.4	51.0
9. buttock-knee length, sitting		59.6(98.5)	61.6(100.5)	66.1(105.0)	71.0(109.9)	73.2(112.1)
10. buttock-popliteal length, sitting		48.7(87.7)	50.5(89.5)	54.5(93.5)	58.7(97.7)	60.5(99.5)
11. shoulder breadth, sitting		52.5	54.0	57.7	62.3	64.6
12. forearm-forearm breadth, sitting		64.9	66.8	72.6	80.6	84.6
13. hip breadth, sitting		47.7	48.9	52.1	56.6	58.9
<u>Head Dimensions</u>						
14. head breadth		27.6	28.0	29.0	30.0	30.4
15. head length		30.1	30.6	31.8	33.0	33.5
<u>Foot Dimensions</u>						
16. foot length		30.2	31.1	33.1	35.4	36.4
17. ball of foot breadth		11.6	12.0	12.8	13.8	14.2
18. heel breadth		9.5	9.8	10.4	11.3	11.7

TABLE 25. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man Dressed in Ground Troop Clothing for Extreme Cold Weather (cont'd)

Hand Dimensions	Percentile				
	1st	5th	50th	95th	99th
19. hand length	19.3[17.0]	19.9[17.6]	21.4[19.1]	23.1[20.8]	23.8[2
20. palm length	N/A [9.4]	N/A [9.8]	N/A [10.8]	N/A [11.9]	N/A [1
21. hand breadth	10.8[8.5]	11.1[8.8]	11.9[9.6]	12.7[10.4]	13.1[1
22. index finger breadth		N/A [2.3]	N/A [2.5]	N/A [2.7]	
23. middle finger breadth		N/A [N/A]	N/A [N/A]	N/A [N/A]	
24. grip breadth, inside		2.8[3.7]	3.4[4.3]	4.1[5.0]	
25. grip breadth, outside		9.9[9.4]	11.3[10.8]	12.4[11.9]	
26. hand clearance around knob, hypothenar		7.5[5.6]	9.9[8.0]	11.7[9.8]	
27. hand clearance around knob, palmar		7.7[3.8]	8.4[4.5]	9.9[6.0]	
28. hand clearance around knob, supinated		13.5[10.2]	15.3[12.0]	16.1[12.8]	

NOTE: Scores in parentheses indicate the predicted measurement when the large ALICE pack with frame (LC-1) is worn.
Scores in brackets indicate the predicted measurement when only the trigger finger inserts are worn.

TABLE 26. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather and
Chemical Protection

		Percentile				
		1st	5th	50th	95th	99th
<u>Body Dimensions</u>						
1. stature		167.8	172.7	183.3	194.5	199.2
2. chest depth, standing		34.8	35.8	38.6	42.3	44.4
3. functional reach, standing		76.2	79.2	86.7	95.2	98.9
4. vertical arm reach, sitting		100.6	104.6	114.1	123.7	128.5
5. sitting height		88.0	90.5	96.8	102.7	105.2
6. eye height, sitting		68.2	70.9	76.9	82.7	85.1
7. knee height, sitting		53.5	55.5	59.8	64.5	66.4
8. popliteal height, sitting		40.4	42.2	46.1	50.4	52.0
9. buttock-knee length, sitting		61.4	63.4	67.9	72.8	75.0
10. buttock-popliteal length, sitting		46.2	48.0	52.0	56.2	58.0
11. shoulder breadth, sitting		55.0	56.5	60.2	64.8	67.1
12. forearm-forearm breadth, sitting		69.6	71.5	77.3	85.3	89.3
13. hip breadth, sitting		52.1	53.3	56.5	61.0	63.3
<u>Head Dimensions</u>						
14. head breadth		28.7	29.1	30.1	31.1	31.5
15. head length		33.1	33.6	34.8	36.0	36.5
<u>Foot Dimensions</u>						
16. foot length		35.5	36.4	38.4	40.7	41.7
17. ball of foot breadth		14.9	15.3	16.1	17.1	17.5
18. heel breadth		9.6	9.9	10.5	11.4	11.8

TABLE 26. Predicted Anthropometric Measurements (in Centimeters) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather and
Chemical Protection

<u>Hand Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
19. hand length	18.3[19.0]	18.9[19.6]	20.4[21.1]	22.1[22.8]	22.8[23
20. palm length	N/A [N/A]	N/A [N/A]	N/A [N/A]	N/A [N/A]	N/A [N/
21. hand breadth	10.4[11.2]	10.7[11.5]	11.5[12.3]	12.3[13.1]	12.7[13
22. index finger breadth	N/A [N/A]	N/A [N/A]	N/A [N/A]	N/A [N/A]	N/A [N/
23. middle finger breadth	N/A [N/A]	N/A [N/A]	N/A [N/A]	N/A [N/A]	N/A [N/
24. grip breadth, inside		3.1[2.5]	3.7[3.1]	4.4[3.8]	
25. grip breadth, outside		9.8[9.7]	11.2[11.1]	12.3[12.2]	
26. hand clearance around knob, hypothenar		7.5[7.5]	9.8[9.8]	11.7[11.7]	
27. hand clearance around knob, palmar		8.9[9.4]	9.6[10.1]	11.1[11.6]	
28. hand clearance around knob, supinated		13.2[13.4]	15.0[15.2]	15.8[16.0]	

NOTE: Scores in brackets indicate the predicted measurement when the black leather shells are worn over the CB gloves and under the Arctic mittens.

TABLE 27. Predicted Anthropometric Measurements (in Inches) of the
US Army Armor Crewman Dressed for Hot Weather

<u>Body Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature	65.1	66.6	70.9	75.3	76.8
2. chest depth, standing	9.2	9.7	10.9	12.5	13.4
3. functional reach, standing	28.8	30.0	33.1	36.5	37.8
4. vertical arm reach, sitting	48.3	49.6	53.4	57.2	59.5
5. sitting height	33.1	34.1	36.6	39.2	40.3
6. eye height, sitting	26.9	27.9	30.4	32.8	34.0
7. knee height, sitting	19.7	20.7	22.6	24.4	25.0
8. popliteal height, sitting	16.7	17.2	18.6	20.4	20.9
9. buttock-knee length, sitting	21.4	22.1	24.0	26.1	27.1
10. buttock-popliteal length, sitting	17.9	18.4	20.0	21.7	22.6
11. shoulder breadth, sitting	15.9	16.7	18.1	20.2	21.0
12. forearm-forearm breadth, sitting	16.9	17.7	20.3	23.7	25.6
13. hip breadth, sitting	12.7	13.1	14.4	16.4	17.2
<u>Head Dimensions</u>					
14. head breadth	11.0	11.2	11.5	11.9	12.1
15. head length	10.5	10.7	11.2	11.7	11.8
<u>Foot Dimensions</u>					
16. foot length	10.7	11.1	11.9	12.8	13.1
17. ball of foot breadth	3.8	4.0	4.3	4.6	4.8
18. heel breadth	3.0	3.1	3.4	3.8	4.0
<u>Hand Dimensions</u>					
19. hand length	6.7	7.0	7.6	8.3	8.7
20. palm length	3.5	3.7	4.2	4.6	4.8
21. hand breadth	3.2	3.3	3.6	3.9	4.1
22. index finger breadth		0.9	0.9	1.0	
23. middle finger breadth		0.8	0.9	1.0	
24. grip breadth, inside		1.6	1.9	2.1	
25. grip breadth, outside		3.7	4.2	4.6	
26. hand clearance around knob, hypothenar		1.9	2.7	3.5	
27. hand clearance around knob, palmar		1.3	1.5	2.1	
28. hand clearance around knob, supinated		3.7	4.4	4.8	

TABLE 28. Predicted Anthropometric Measurements (in Inches) of the
US Army Armor Crewman Dressed for Hot Weather
and Chemical Protection

<u>Body Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature	65.3	66.8	71.1	75.4	76.9
2. chest depth, standing	10.3	10.8	11.9	13.6	14.4
3. functional reach, standing	28.9	29.7	32.8	36.2	37.4
4. vertical arm reach, sitting	47.4	48.8	52.6	56.3	58.6
5. sitting height	33.1	34.0	36.6	39.1	40.3
6. eye height sitting	26.9	27.8	30.4	32.7	33.9
7. knee height, sitting	19.9	20.9	22.8	24.6	25.2
8. popliteal height, sitting	16.3	16.9	18.3	20.0	20.6
9. buttock-knee length, sitting	22.0	22.7	24.6	26.7	27.7
10. buttock-popliteal length, sitting	17.2	17.7	19.3	20.9	21.9
11. shoulder breadth, sitting	18.7	19.4	20.9	23.0	23.8
12. forearm-forearm breadth, sitting	20.7	21.5	24.1	27.5	29.4
13. hip breadth, sitting	14.6	14.9	16.3	18.2	19.0
<u>Head Dimensions</u>					
14. head breadth	11.0	11.2	11.6	12.0	12.2
15. head length	10.0	10.2	10.7	11.0	11.3
<u>Foot Dimensions</u>					
16. foot length	12.6	13.0	13.8	14.7	15.0
17. ball of foot breadth	5.6	5.8	6.1	6.5	6.7
18. heel breadth	4.6	4.7	5.0	5.4	5.6
<u>Hand Dimensions</u>					
19. hand length	6.9	7.1	7.8	8.4	8.9
20. palm length	3.8	4.0	4.4	4.9	5.1
21. hand breadth	3.5	3.6	3.9	4.2	4.4
22. index finger breadth		0.9	1.0	1.1	
23. middle finger breadth		0.9	1.0	1.1	
24. grip breadth, inside		1.4	1.7	1.9	
25. grip breadth, outside		3.7	4.3	4.7	
26. hand clearance around knob, hypothenar		2.2	3.1	3.9	
27. hand clearance around knob, palmar		1.7	1.9	2.5	
28. hand clearance around knob, supinated		3.9	4.6	4.9	

TABLE 29. Predicted Anthropometric Measurements (in Inches) of the
US Army Armor Crewman Dressed for Extreme Cold Weather

<u>Body Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature	65.6	67.1	71.5	75.8	77.3
2. chest depth, standing	10.7	11.2	12.3	14.0	14.8
3. functional reach, standing	28.0	29.2	32.3	35.7	37.0
4. vertical arm reach, sitting	42.1	43.5	47.2	51.0	53.3
5. sitting height	33.5	34.4	37.0	39.6	40.7
6. eye height, sitting	26.9	27.9	30.4	32.8	34.0
7. knee height, sitting	20.1	21.1	22.9	24.7	25.4
8. popliteal height, sitting	15.2	15.7	17.1	18.9	19.4
9. buttock-knee length, sitting	22.1	22.9	24.7	26.8	27.8
10. buttock-popliteal length, sitting	16.0	16.6	18.1	19.8	20.7
11. shoulder breadth, sitting	19.3	20.1	21.5	23.7	24.4
12. forearm-forearm breadth, sitting	21.5	22.2	24.9	28.3	30.2
13. hip breadth, sitting	14.8	15.2	16.5	18.5	19.3
<u>Head Dimensions</u>					
14. head breadth	11.1	11.3	11.7	12.0	12.2
15. head length	10.8	11.0	11.5	12.0	12.1
<u>Foot Dimensions</u>					
16. foot length	11.1	11.5	12.3	13.3	13.6
17. ball of foot breadth	4.3	4.5	4.8	5.2	5.4
18. heel breadth	3.5	3.5	3.8	4.2	4.4
<u>Hand Dimensions</u>					
19. hand length	6.9	7.2	7.8	8.5	8.9
20. palm length	3.9	4.1	4.5	4.9	5.1
21. hand breadth	3.4	3.5	3.9	4.2	4.4
22. index finger breadth		0.9	1.0	1.1	
23. middle finger breadth		0.9	1.0	1.1	
24. grip breadth, inside		1.5	1.7	2.0	
25. grip breadth, outside		3.8	4.3	4.8	
26. hand clearance around knob, hypothenar		2.2	3.1	3.9	
27. hand clearance around knob, palmar		1.4	1.7	2.2	
28. hand clearance around knob, supinated		4.0	4.7	5.0	

TABLE 30. Predicted Anthropometric Measurements (in Inches) of the
US Army Armor Crewman Dressed for Extreme Cold Weather
Chemical Protection

<u>Body Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature	65.7	67.2	71.6	75.9	77.4
2. chest depth, standing	12.7	13.2	14.4	16.0	16.9
3. functional reach, standing	28.7	30.0	33.0	36.4	37.6
4. vertical arm reach, sitting	40.8	42.2	45.9	49.7	52.0
5. sitting height	33.7	34.6	37.2	39.7	40.9
6. eye height, sitting	26.6	27.6	30.1	32.4	33.7
7. knee height, sitting	20.4	21.5	23.3	25.1	25.7
8. popliteal height, sitting	15.1	15.6	17.0	18.8	19.4
9. buttock-knee length, sitting	23.0	23.8	25.6	27.7	28.7
10. buttock-popliteal length, sitting	16.9	17.4	18.9	20.6	21.5
11. shoulder breadth, sitting	20.0	20.8	22.2	24.4	25.2
12. forearm-forearm breadth, sitting	26.7	27.6	30.2	33.7	35.6
13. hip breadth, sitting	16.4	16.8	18.1	20.1	20.9
<u>Head Dimensions</u>					
14. head breadth	11.3	11.5	11.9	12.2	12.4
15. head length	10.2	10.4	10.9	11.3	11.5
<u>Foot Dimensions</u>					
16. foot length	13.2	13.6	14.4	15.4	15.7
17. ball of foot breadth	5.9	6.1	6.5	6.8	7.0
18. heel breadth	4.7	4.8	5.1	5.5	5.7
<u>Hand Dimensions</u>					
19. hand length	7.0	7.2	7.9	8.6	9.0
20. palm length	4.4	4.6	5.0	5.5	5.7
21. hand breadth	3.6	3.7	4.1	4.4	4.6
22. index finger breadth		1.1	1.1	1.2	
23. middle finger breadth		1.0	1.1	1.2	
24. grip breadth, inside		1.3	1.5	1.8	
25. grip breadth, outside		3.7	4.3	4.7	
26. hand clearance around knob, hypothenar		2.4	3.4	4.1	
27. hand clearance around knob, palmar		1.5	1.8	2.4	
28. hand clearance around knob, supinated		4.1	4.8	5.2	

TABLE 31. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather

	Body Dimensions	Percentile				
		1st	5th	50th	95th	99th
	1. stature	64.4	66.3	70.5	74.9	76.8
	2. chest depth, standing	10.1(26.1)	10.5(26.5)	11.6(27.6)	13.1(29.1)	13.9(29.9)
	3. functional reach, standing	29.0(43.6)	30.2(44.8)	33.1(47.7)	36.5(51.1)	37.9(52.5)
	4. vertical arm reach, sitting	46.5(45.2)	48.1(46.8)	51.8(50.5)	55.6(54.3)	57.5(56.2)
	5. sitting height	33.0	34.0	36.5	38.8	39.8
	6. eye height, sitting	27.1	28.2	30.6	32.8	33.8
	7. knee height, sitting	20.1	20.9	22.6	24.4	25.2
	8. popliteal height, sitting	16.3	17.0	18.5	20.2	20.8
	9. buttock-knee length, sitting	22.7(36.5)	23.5(37.2)	25.2(39.0)	27.2(40.9)	28.0(41.8)
46	10. buttock-popliteal length, sitting	18.5(33.1)	19.3(33.9)	20.8(35.4)	22.5(37.1)	23.2(37.8)
	11. shoulder breadth, sitting	16.3	16.9	18.4	20.2	21.1
	12. forearm-forearm breadth, sitting	20.0	20.8	23.1	26.2	27.8
	13. hip breadth, sitting	17.2	17.7	19.0	20.7	21.7
	<u>Head Dimensions</u>					
	14. head breadth	8.9	9.1	9.5	9.9	10.0
	15. head length	10.6	10.7	11.2	11.7	11.9
	<u>Foot Dimensions</u>					
	16. foot length	10.7	11.1	11.9	12.8	13.1
	17. ball of foot breadth	3.8	4.0	4.3	4.7	4.8
	18. heel breadth	3.0	3.1	3.3	3.7	3.9

TABLE 31. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather (cont'd)

<u>Hand Dimensions</u>	<u>Precentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
19. hand length	6.7	6.9	7.5	8.1	8.4
20. palm length	3.6	3.8	4.2	4.6	4.8
21. hand breadth	3.1	3.2	3.5	3.8	4.0
22. index finger breadth		0.7	0.8	0.9	
23. middle finger breadth		0.7	0.8	0.9	
24. grip breadth, inside		1.7	1.9	2.2	
25. grip breadth, outside		3.7	4.2	4.6	
26. hand clearance around knob, hypothenar		1.7	2.7	3.4	
27. hand clearance around knob, palmar		1.2	1.5	2.1	
28. hand clearance around knob, supinated		3.3	4.1	4.4	

NOTE: Scores in parentheses indicate the predicted measurement when the large ALICE pack with frame (LC-1) is worn.

TABLE 32. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather
and Chemical Protection

		Precentile				
<u>Body Dimensions</u>		<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1.	stature	65.1	67.0	71.2	75.6	77.5
2.	chest depth, standing	11.1	11.5	12.6	14.1	14.9
3.	functional reach, standing	28.6	29.8	32.8	36.1	37.6
4.	vertical arm reach, sitting	45.5	47.1	50.8	54.6	56.5
5.	sitting height	33.3	34.3	36.8	39.1	40.1
6.	eye height, sitting	27.0	28.0	30.4	32.7	33.6
7.	knee height, sitting	20.5	21.3	23.0	24.8	25.6
8.	popliteal height, sitting	15.9	16.7	18.2	19.9	20.5
9.	buttock-knee length, sitting	22.4	23.1	24.9	26.9	27.7
10.	buttock-popliteal length, sitting	17.7	18.4	20.0	21.7	22.4
11.	shoulder breadth, sitting	18.3	18.9	20.4	22.2	23.1
12.	forearm-forearm breadth, sitting	22.9	23.6	25.9	29.1	30.6
13.	hip breadth, sitting	18.2	18.7	19.9	21.7	22.6
<u>Head Dimensions</u>						
14.	head breadth	8.9	9.1	9.5	9.9	10.0
15.	head length	10.6	10.7	11.2	11.7	11.9
<u>Foot Dimensions</u>						
16.	foot length	12.7	13.0	13.8	14.7	15.1
17.	ball of foot breadth	5.7	5.8	6.1	6.5	6.7
18.	heel breadth	4.0	4.1	4.4	4.7	4.9

TABLE 32. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Hot Weather
and Chemical Protection (cont'd)

<u>Hand Dimensions</u>	<u>Percentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
19. hand length	6.6[6.9]	6.9[7.2]	7.5[7.8]	8.1[8.4]	8.4[8.7]
20. palm length	3.9[4.2]	4.1[4.4]	4.5[4.8]	4.9[5.2]	5.1[5.4]
21. hand breadth	3.3[3.5]	3.4[3.6]	3.7[3.9]	4.0[4.3]	4.2[4.4]
22. index finger breadth		0.8[1.0]	0.9[1.1]	1.0[1.1]	
23. middle finger breadth		0.8[1.0]	0.9[1.1]	1.0[1.1]	
24. grip breadth, inside		1.6[2.0]	1.8[1.7]	2.1[1.9]	
25. grip breadth, outside		3.7[3.8]	4.3[4.3]	4.7[4.8]	
26. hand clearance around knob, hypothenar		2.0[2.7]	2.9[3.7]	3.6[4.4]	
27. hand clearance around knob, palmar		1.3[1.8]	1.6[2.0]	2.2[2.6]	
28. hand clearance around knob, supinated		3.7[4.3]	4.4[5.0]	4.8[5.3]	

NOTE: Scores in brackets indicate the predicted measurement when the black leather gloves are worn over the CB gloves.

TABLE 33. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather

		Precentile				
<u>Body Dimensions</u>		<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature		65.5	67.4	71.6	76.0	77.9
2. chest depth, standing		12.5(27.6)	12.9(28.0)	14.0(29.1)	15.5(30.6)	16.3(31.4)
3. functional reach, standing		31.0(44.0)	32.2(45.2)	35.2(48.1)	38.5(51.5)	40.0(52.9)
4. vertical arm reach, sitting		40.8(40.3)	42.4(41.9)	46.1(45.6)	49.9(49.4)	51.8(51.3)
5. sitting height		34.1	35.1	37.6	39.9	40.9
6. eye height, sitting		27.4	28.5	30.8	33.1	34.1
7. knee height, sitting		20.4	21.2	22.9	24.7	25.5
8. popliteal height, sitting		15.5	16.2	17.8	19.4	20.1
9. buttock-knee length, sitting		23.5(38.8)	24.3(39.6)	26.0(41.3)	28.0(43.3)	28.8(44.1)
10. buttock-popliteal length, sitting		19.2(34.5)	19.9(35.2)	21.5(36.8)	23.1(38.5)	23.8(39.2)
11. shoulder breadth, sitting		20.7	21.3	22.7	24.5	25.4
12. forearm-forearm breadth, sitting		25.6	26.3	28.6	31.7	33.3
13. hip breadth, sitting		18.8	19.3	20.5	22.3	23.2
<u>Head Dimensions</u>						
14. head breadth		10.9	11.0	11.4	11.8	12.0
15. head length		11.9	12.0	12.5	13.0	13.2
<u>Foot Dimensions</u>						
16. foot length		11.9	12.2	13.0	13.9	14.3
17. ball of foot breadth		4.6	4.7	5.0	5.4	5.6
18. heel breadth		3.7	3.9	4.1	4.4	4.6

TABLE 33. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather (cont'd)

<u>Hand Dimensions</u>	<u>Precentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
19. hand length	7.6[6.7]	7.8[6.9]	8.4[7.5]	9.1[8.2]	9.4[8.5]
20. palm length	N/A[3.7]	N/A[3.9]	N/A[4.3]	N/A[4.7]	N/A[4.9]
21. hand breadth	4.3[3.3]	4.4[3.5]	4.7[3.8]	5.0[4.1]	5.2[4.3]
22. index finger breadth		N/A[0.9]	N/A[1.0]	N/A[1.1]	
23. middle finger breadth		N/A[N/A]	N/A[N/A]	N/A[N/A]	
24. grip breadth, inside		1.1[1.5]	1.3[1.7]	1.6[2.0]	
25. grip breadth, outside		3.9[3.7]	4.4[4.3]	4.9[4.7]	
26. hand clearance around knob, hypothenar		3.0[2.2]	3.9[3.1]	4.6[3.9]	
27. hand clearance around knob, palmar		3.0[1.5]	3.3[1.8]	3.9[2.4]	
28. hand clearance around knob, supinated		5.3[4.0]	6.0[4.7]	6.3[5.0]	

NOTE: Scores in parentheses indicate the predicted measurement when the large ALICE pack with frame (LC-1) is worn.

Scores in brackets indicate the predicted measurement when only the trigger finger inserts are worn.

TABLE 34. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather
and Chemical Protection

	Percentile				
<u>Body Dimensions</u>	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
1. stature	66.1	68.0	72.2	76.6	78.4
2. chest depth, standing	13.7	14.1	15.2	16.7	17.5
3. functional reach, standing	30.0	31.2	34.1	37.5	38.9
4. vertical arm reach, sitting	39.6	41.2	44.9	48.7	50.6
5. sitting height	34.6	35.6	38.1	40.4	41.4
6. eye height, sitting	26.9	27.9	30.3	32.6	33.5
7. knee height, sitting	21.1	21.9	23.5	25.4	26.1
8. popliteal height, sitting	15.9	16.6	18.1	19.8	20.5
9. buttock-knee length, sitting	24.2	25.0	26.7	28.7	29.5
10. buttock-popliteal length, sitting	18.2	18.9	20.5	22.1	22.8
11. shoulder breadth, sitting	21.7	22.2	23.7	25.5	26.4
12. forearm-forearm breadth, sitting	27.4	28.1	30.4	33.6	35.2
13. hip breadth, sitting	20.5	21.0	22.2	24.0	24.9
<u>Head Dimensions</u>					
14. head breadth	11.3	11.5	11.9	12.2	12.4
15. head length	13.0	13.2	13.7	14.2	14.4
<u>Foot Dimensions</u>					
16. foot length	14.0	14.3	15.1	16.0	16.4
17. ball of foot breadth	5.9	6.0	6.3	6.7	6.9
18. heel breadth	3.8	3.9	4.1	4.5	4.6

TABLE 34. Predicted Anthropometric Measurements (in Inches) of the US Army Man
Dressed in Ground Troop Clothing for Extreme Cold Weather
and Chemical Protection (cont'd)

<u>Hand Dimensions</u>	<u>Precentile</u>				
	<u>1st</u>	<u>5th</u>	<u>50th</u>	<u>95th</u>	<u>99th</u>
19. hand length	7.2[7.5]	7.4[7.7]	8.0[8.3]	8.7[9.0]	9.0[9.3]
20. palm length	N/A[N/A]	N/A[N/A]	N/A[N/A]	N/A[N/A]	N/A[N/A]
21. hand breadth	4.1[4.4]	4.2[4.5]	4.5[4.8]	4.8[5.2]	5.0[5.3]
22. index finger breadth		N/A[N/A]	N/A[N/A]	N/A[N/A]	
23. middle finger breadth		N/A[N/A]	N/A[N/A]	N/A[N/A]	
24. grip breadth, inside		1.2[1.0]	1.5[1.2]	1.7[1.5]	
25. grip breadth, outside		3.9[3.8]	4.4[4.4]	4.8[4.8]	
26. hand clearance around knob, hypothenar		3.0[3.0]	3.9[3.9]	4.6[4.6]	
27. hand clearance around knob, palmar		3.5[3.7]	3.8[4.0]	4.4[4.6]	
28. hand clearance around knob, supinated		5.2[5.3]	5.9[6.0]	6.2[6.3]	

NOTE: Scores in brackets indicate the predicted measurement when the black leather shells are worn over the CB gloves and under the Arctic mittens.

FIGURES



Figure 1a. Combat vehicle crewman's clothing for hot weather (front view)



Figure 1b. Combat vehicle crewman's clothing for hot weather (side view)



Figure 2a. Combat vehicle crewman's clothing for hot weather and chemical protection (front view)

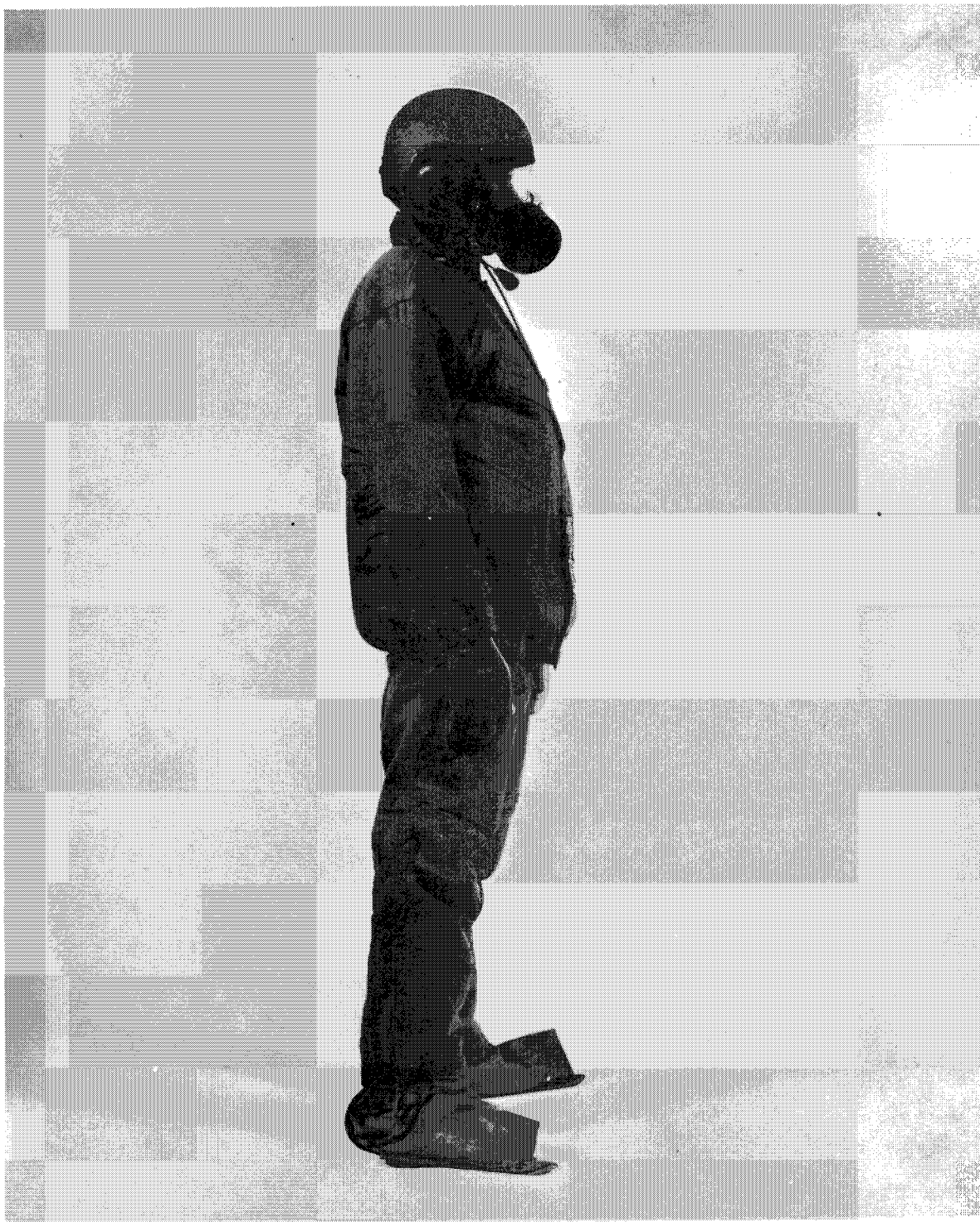


Figure 2b. Combat vehicle crewman's clothing for hot weather and Chemical Protection (side view)



Figure 3a. Combat vehicle crewman's clothing for extreme cold weather
(front view)



Figure 3b. Combat vehicle crewman's clothing for extreme cold weather (side view)



Figure 4a. Combat vehicle crewman's clothing for extreme cold weather and chemical protection (front view)



Figure 4b. Combat vehicle crewman's clothing for extreme cold weather and chemical protection (side view)



Figure 5a. Ground troop clothing for hot weather (front view)



Figure 5b. Ground troop clothing for hot weather (side view)



Figure 5c. Ground troop clothing for hot weather with the large ALICE pack and frame (front view)



Figure 5d. Ground troop clothing for hot weather with the large ALICE pack and frame (side view)



Figure 6a. Ground troop clothing for hot weather and chemical protection
(front view)



Figure 6b. Ground troop clothing for hot weather and chemical protection
(side view)



Figure 7a. Ground troop clothing for extreme cold weather (front view)



Figure 7b. Ground troop clothing for extreme cold weather (side view)



Figure 7c. Ground troop clothing for extreme cold weather with the large ALICE pack and frame (front view)



Figure 7d. Ground troop clothing for extreme cold weather with the large ALICE pack and frame (side view)



Figure 8a. Ground troop clothing for extreme cold weather and chemical protection (front view)



Figure 8b. Ground troop clothing for extreme cold weather and chemical protection (side view)

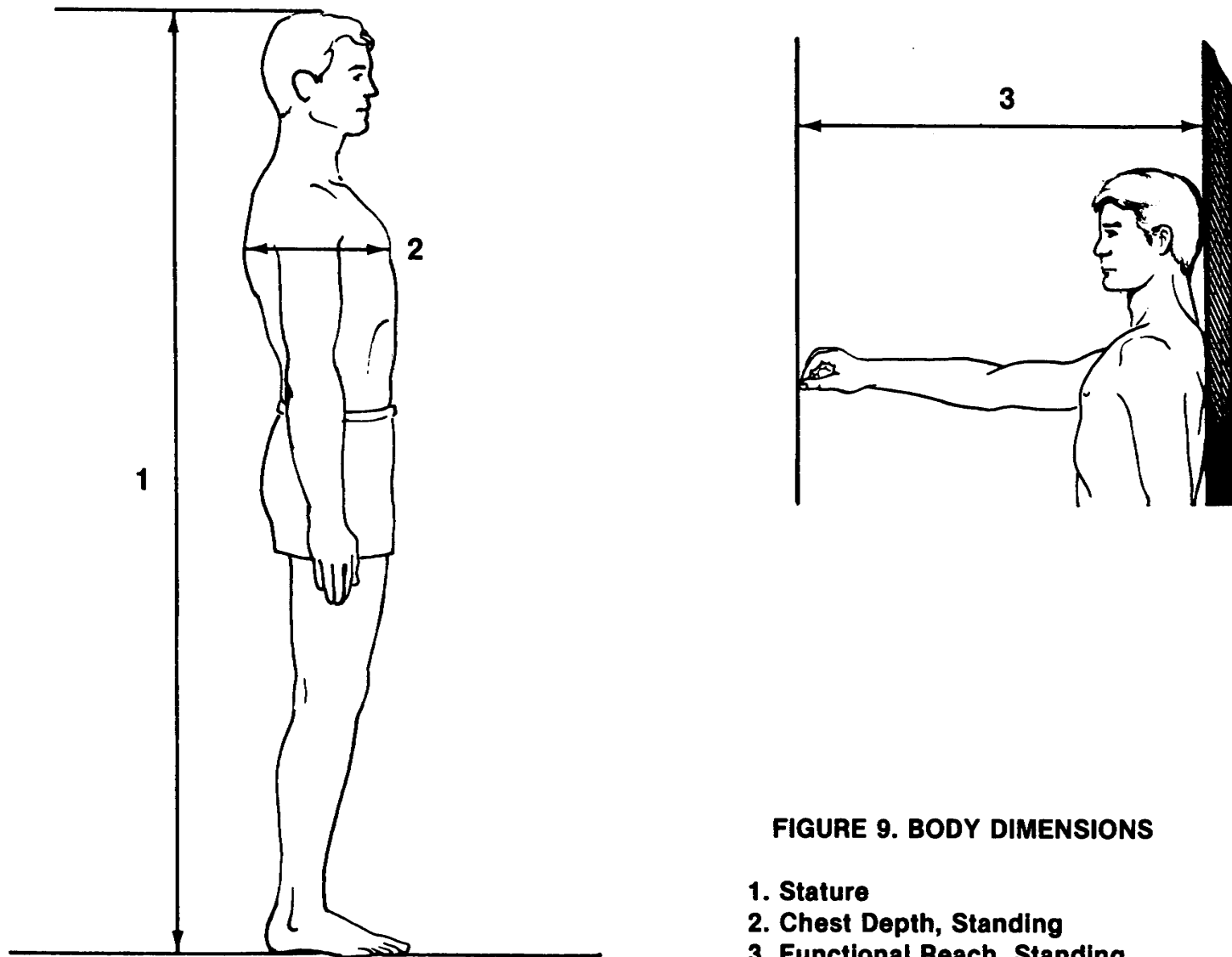


FIGURE 9. BODY DIMENSIONS

- 1. Stature**
- 2. Chest Depth, Standing**
- 3. Functional Reach, Standing**

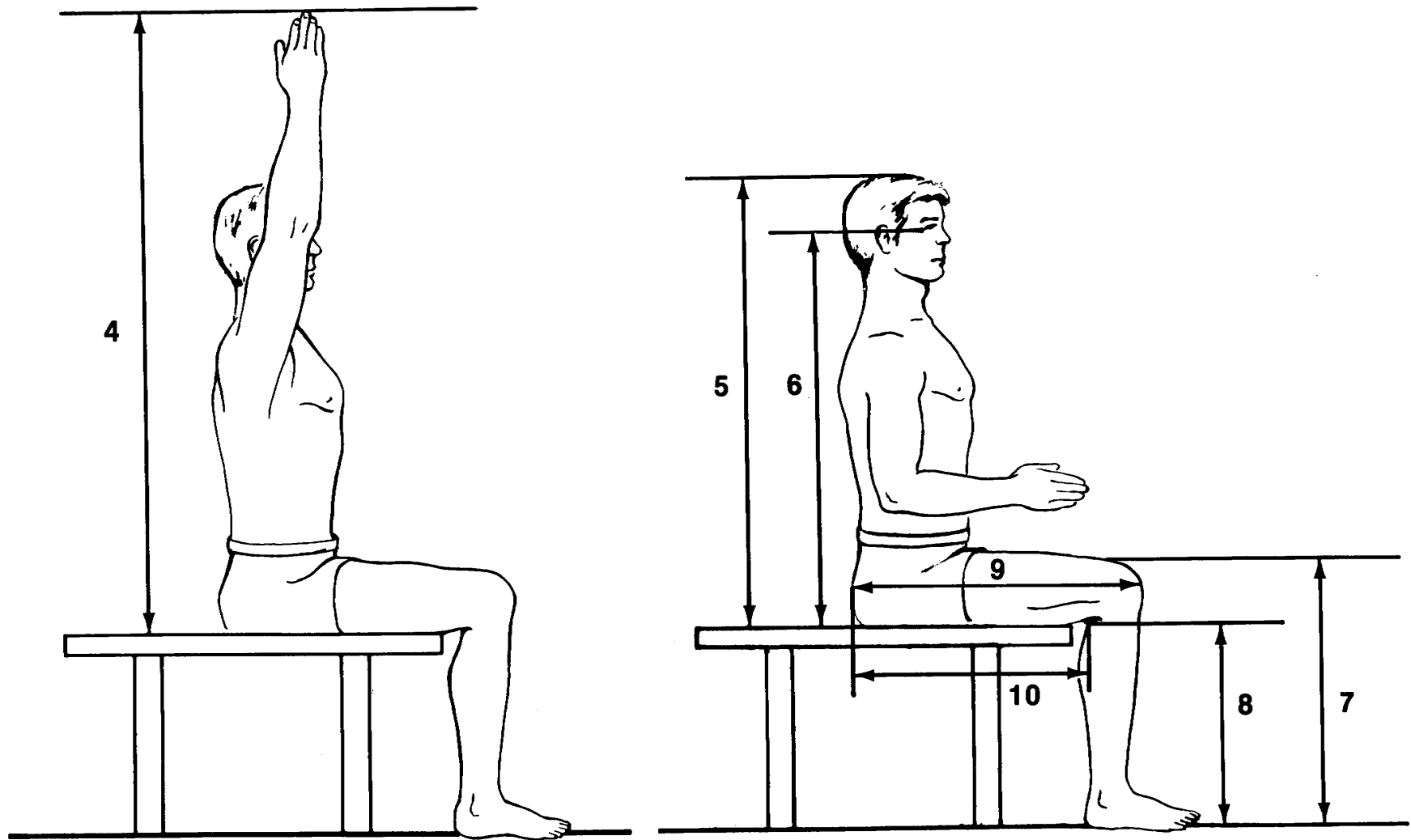


FIGURE 10. BODY DIMENSIONS (CONT'D)

- 4. Vertical Arm Reach, Sitting**
- 5. Sitting Height**
- 6. Eye Height, Sitting**
- 7. Knee Height, Sitting**

- 8. Popliteal Height, Sitting**
- 9. Buttock-Knee Length, Sitting**
- 10. Buttock-Popliteal Length, Sitting**

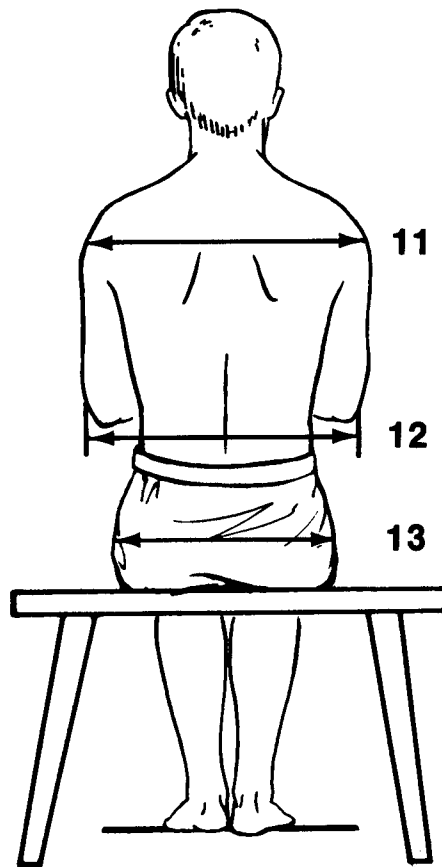


FIGURE 11. BODY DIMENSIONS (CONT'D)

- 11. Shoulder Breadth, Sitting**
- 12. Forearm-Forearm Breadth, Sitting**
- 13. Hip Breadth, Sitting**

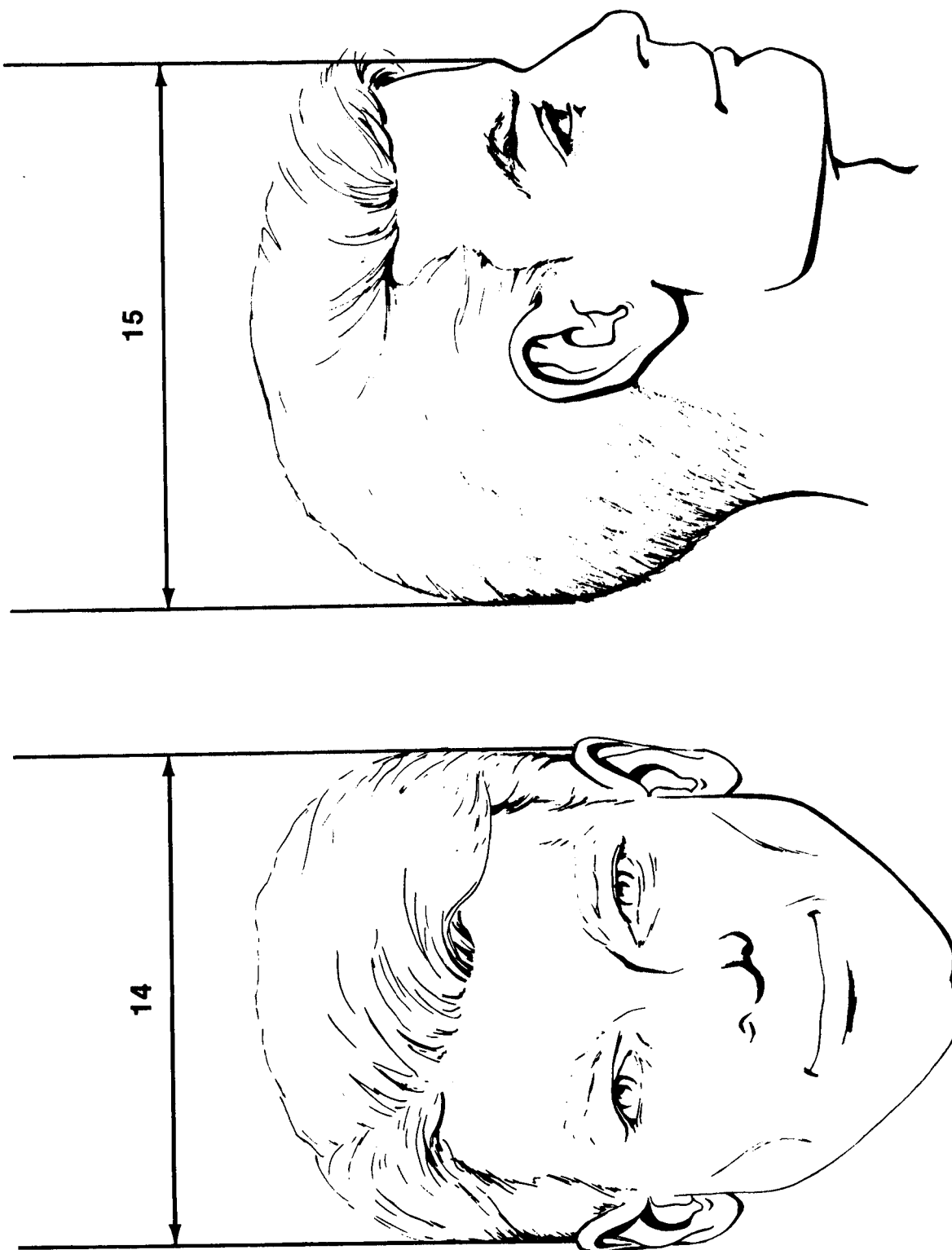


FIGURE 12. HEAD DIMENSIONS

14. Head Breadth

15. Head Length

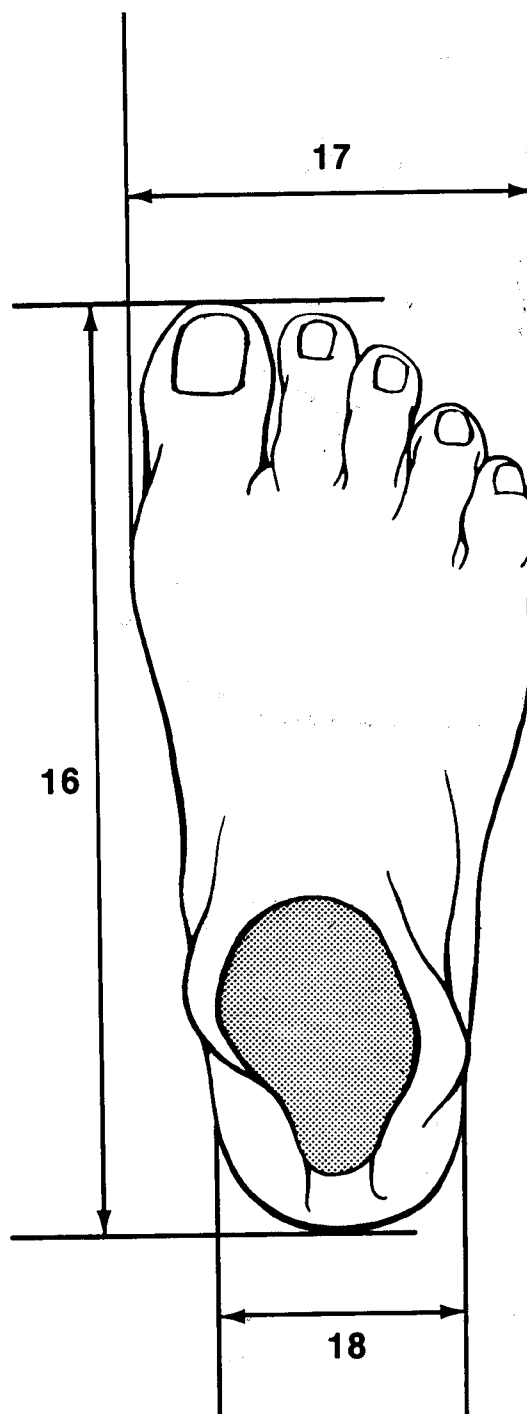


FIGURE 13. FOOT DIMENSIONS

- 16. Foot Length**
- 17. Ball-of Foot Breadth**
- 18. Heel Breadth**

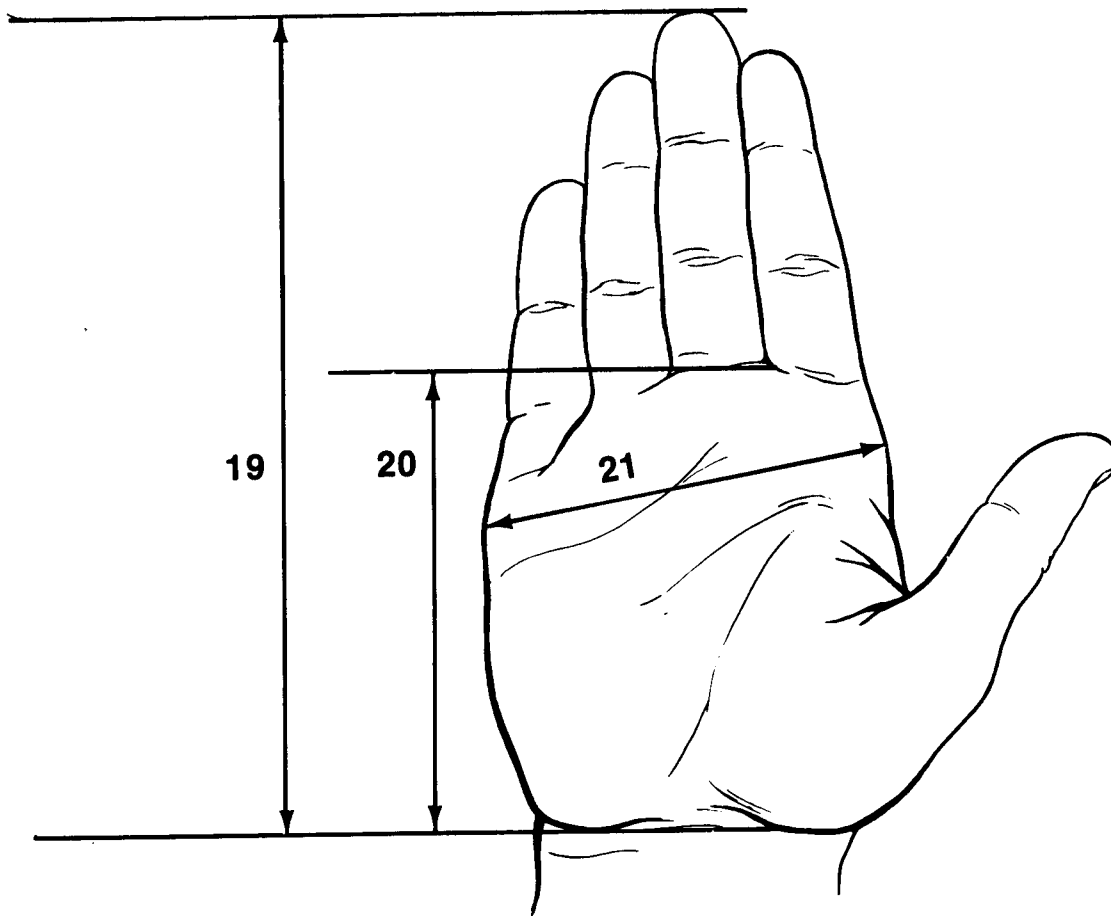


FIGURE 14. HAND DIMENSIONS

- 19. Hand Length**
- 20. Palm Length**
- 21. Hand Breadth**

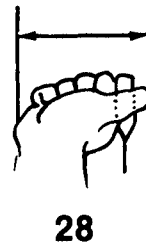
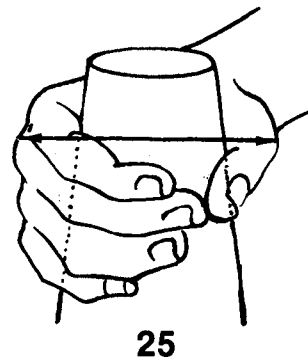
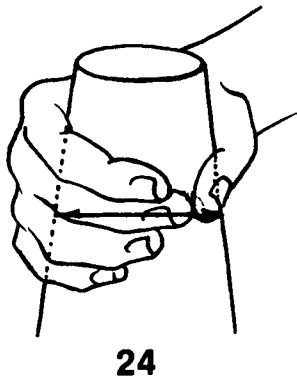
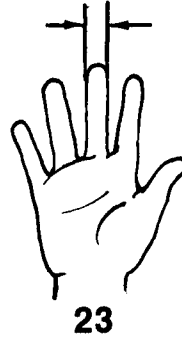
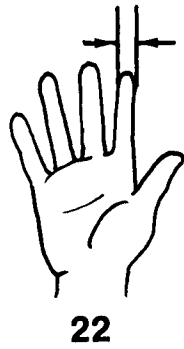


FIGURE 15. HAND DIMENSIONS (CONT'D)

- 22. Index Finger Breadth
- 23. Middle Finger Breadth
- 24. Grip Breadth, Inside
- 25. Grip Breadth, Outside

- 26. Hand Clearance Around Knob, Hypothenar (0°)
- 27. Hand Clearance Around Knob, Palmar (90°)
- 28. Hand Clearance Around Knob, Supinated (180°)

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APPENDIX

DEFINITIONS OF ANTHROPOMETRIC MEASUREMENTS*

Body Measurements

1. Stature. The subject stands erect with the heels together and head level. Stature is measured as the vertical distance from the floor to the top of the head. An anthropometer is used with the anthropometer arm firmly touching the scalp to compress the hair. Stature of the clothed man is increased by footwear such as socks, boots, and overboots and by headgear such as pile cap, balaclava, helmet, and hood.

2. Chest depth, standing. The subject stands erect, with his arms initially raised then lowered after the anthropometer is in place under the right arm. The depth of the chest is measured at the level of the nipples during normal breathing. An anthropometer is used and is held horizontally. Chest depth of the clothed man is increased by clothing and equipment over the back and over the chest.

3. Functional reach, standing. The subject stands erect against a wall, with his right arm extended forward horizontally, and with the tips of his thumb and index finger pressed together; his shoulders must remain in contact with the wall. Functional reach is measured as the horizontal distance from the wall to the tip of the thumb. An anthropometer is used. Functional reach of the clothed man is increased by the clothing and equipment on the back and by handwear; it is decreased by inhibition of arm-shoulder joint mobility due to clothing and equipment bulk in that area.

4. Vertical arm reach, sitting. The subject sits erect, with his right arm and hand extended vertically above his shoulder. Arm reach is measured as the vertical distance from the sitting surface to the tip of the middle finger of the extended hand. An anthropometer is used. Vertical arm reach of the clothed man is increased by handwear and by clothing under the hips; it is decreased by inhibition of arm-shoulder joint mobility due to the clothing and equipment bulk in that area.

5. Sitting height. The subject sits erect, with head level, and with his feet resting on a surface adjusted so that his knees are bent at right angles. Sitting height is measured as the vertical distance from the sitting surface to the top of the head. An anthropometer is used, with the anthropometer arm firmly touching the scalp to compress the hair. Sitting height of the clothed man is increased by the clothing under the hips and leg, and by headgear such as pile cap, balaclava, helmet, and hood.

6. Eye height, sitting. the subject sits erect with head level, and with his feet resting on a surface adjusted so that his knees are bent at right angles. Eye height is measured as the vertical distance from the

* Measurements 1 through 21 are adapted from White and Churchill;⁶ measurements 22 through 28 are adapted from Garret.⁷

sitting surface to the inner corner of the right eye. An anthropometer is used. Eye height of the clothed man is increased by clothing under the hips.

7. Knee height, sitting. The subject sits erect, with his feet resting on a surface adjusted so that his knees are bent at right angles. Knee height is measured as the vertical distance from the footrest surface to the top of the right knee. An anthropometer is used. Knee height of the clothed man is increased by footwear such as socks, boots, and overboots and by the trouser leg materials over the knee.

8. Popliteal height, sitting. The subject sits erect, with his feet resting on a surface adjusted so that his knees are bent at right angles. Popliteal height is measured as the vertical distance from the footrest surface to the underside of the right knee (popliteal area). An anthropometer is used. Popliteal height of the clothed man is increased by footwear such as socks, boots, and overboots; it is decreased by trouser leg materials at the popliteal area.

9. Buttock-knee length, sitting. The subject sits erect, with his feet resting on a surface adjusted so that his knees are bent at right angles. Buttock-knee length is measured as the horizontal distance from the back of the right buttock to the front of the right knee. An anthropometer is used. Buttock-knee length of the clothed man is increased by clothing and equipment over the hip and by trouser material over the knee.

10. Buttock-popliteal length, sitting. The subject sits erect with his feet resting on a surface adjusted so that his knees are bent at right angles. Buttock-popliteal length is measured as the horizontal distance from the back of the right buttock to the back of the right knee (popliteal area). An anthropometer is used. Buttock-popliteal length of the clothed man is increased by clothing and equipment over the hip; it is decreased by trouser leg materials at the popliteal area.

11. Shoulder breadth, sitting. The subject sits erect with his arms bent to form right angles at the elbows and with his elbows held against the body. The maximum breadth across the shoulders is measured at the bulges of the deltoid muscles in the upper arms. An anthropometer is used and is held horizontally. Shoulder breadth of the clothed man is increased by clothing and equipment between the torso and the upper arms and by clothing material over the upper arms.

12. Forearm-forearm breadth, sitting. The subject sits erect, with his arms bent to form right angles at the elbows, and with his elbows held against the body. The maximum breadth across the body is measured, including the arms at the level of the forearm muscles. An anthropometer is used and is held horizontally. Forearm-forearm breadth of the clothed man is increased by clothing and equipment between the torso and the arms and by clothing material over the arms in the area of elbows and forearms.

13. Hip breadth, sitting. The subject sits erect with his knees together. The maximum breadth across the hips is measured. An anthropometer is used and is held horizontally. Hip breadth of the clothed man is increased by clothing and equipment over the hips.

Head Measurements

14. Head breadth. The subject sits erect with the head level. The maximum horizontal breadth of the head is measured above and behind the ears. Spreading calipers are used. Head breadth of the clothed man is increased by headgear such as pile cap, balaclava, helmet, hood, and earphones.

15. Head length. The subject sits erect with the head level. The maximum length of the head is measured from the back of the head (occiput) to the forehead (glabella). Spreading calipers are used. Head length of the clothed man is increased by headgear such as the pile cap, balaclava, helmet, hood, and mask.

Foot Measures

16. Foot Length. The subject stands erect with his right foot in a foot measuring box, and with his weight evenly distributed on both feet. The maximum length of the right foot is measured from the back of the heel to the tip of the longest toe. A foot measuring box is used. Foot length of the clothed man is increased by footwear such as boots and overboots.

17. Ball of foot breadth. The subject stands erect, with his right foot in a foot measuring box, and with his weight evenly distributed on both feet. The breadth of the right foot is measured between the inner and outer balls of the foot (first and fifth metatarsal-phalangeal joints). A foot measuring box is used. Ball of foot breadth of the clothed man is increased by footwear such as socks, boots and overboots.

18. Heel breadth. The subject stands erect, with his feet slightly apart, and with his weight evenly distributed on both feet. The breadth of the right heel is measured below and behind the projections of the ankle bones (malleoli). Sliding calipers are used. Heel breadth of the clothed man is increased by footwear such as boots and overboots.

Hand Measures

19. Hand length. The subject sits, with his right hand and fingers extended, palm up. The length of the right hand is measured from the wrist crease to the tip of the middle finger. Sliding calipers are used. Hand length of the clothed man is increased by gloves and mittens.

20. Palm length. The subject sits, with his right hand and fingers extended, palm up. The length of the palm is measured from the wrist crease to the crease at the base of the middle finger. Sliding calipers are used. Palm length of the clothed man is increased by gloves. Since mittens have no base-of-finger landmarks, this measure is not obtained when the subject wears mittens.

21. Hand breadth. The subject sits with his right hand and fingers extended, palm up. The breadth of the hand is measured at the level of the knuckles (distal ends of the metacarpal bones). Sliding calipers are used. Hand breadth of the clothed man is increased by gloves and mittens.

22. Index finger breadth. The subject sits with his right hand and fingers extended. The fingers are slightly separated. The breadth of the index finger is measured by moving the measuring instrument up and down the length of the finger until the point of maximum breadth is found. Sliding calipers are used. Index finger breadth of the clothed man is increased by the wearing of gloves.

23. Middle finger breadth. The subject sits with his right hand and fingers extended. The fingers are slightly separated. The breadth of the middle finger is measured by moving the measuring instrument up and down the length of the finger until the point of maximum breadth is found. Sliding calipers are used. Middle finger breadth of the clothed man is increased by the wearing of gloves.

24. Grip breadth, inside. A hardwood cone (24 inches high, with a 2-inch diameter at the base and a 0.5-inch diameter at the top) is the measuring instrument. Changes in the diameter of the cone to the nearest 0.1 inch are indicated by means of 24 equally-spaced circumferential lines drawn on the cone. The subject holds the cone at the largest circumference he can grasp with his thumb and middle finger just touching. Grip breadth (inside) is measured by reading the diameter of the cone corresponding to this maximum circumference. Grip breadth of the clothed man is decreased by glove and mitten material.

25. Grip breadth, outside. A hardwood cone (24 inches high, with a 2-inch diameter at the base and a 0.5-inch diameter at the top) is used during this measurement. Changes in the diameter of the cone to the nearest 0.1 inch are indicated by means of 24 equally spaced circumferential lines drawn on the cone. The subject holds the cone at the largest circumference he can grasp with his thumb and middle finger just touching. Grip breadth (outside) is measured from the interphalangeal joint of the thumb to the knuckle of the middle finger. Sliding calipers are used. Grip breadth (outside) of the clothed man is increased by glove and mitten material.

26. Hand clearance around knob, hypothenar. A rotation box (see Garret⁷) is used in taking this measurement. The rotation box used in this study consisted of a Class C type rotary knob mounted on a metallic shaft which penetrates the center of an 8" x 8" piece of sheet metal. The subject extends his right hand and grasps the knob between his thumb and forefinger.

The knob points straight up (0°) at this point. Hand clearance around knob (hypothelar) is measured, with the aid of a vertical wooden wedge, from the knob center to the most protrusive point on the hypothelar surface of the hand. Hand clearance around knob (hypothelar) of the clothed man is increased by gloves and mittens.

27. Hand clearance around knob, palmar. A rotation box (see Garrett⁷) is used in taking this measurement. The rotation box is described above. The subject extends his right hand and grasps the knob between his thumb and forefinger. The knob points straight up (0°) at this point. The subject then rotates the knob 90° from zero to the right. Hand clearance around knob (palmar) is measured from the knob center to the most protrusive point on the palmar side of the hand. Hand clearance around knob (palmar) of the clothed man is increased by gloves and mittens.

28. Hand clearance around knob, supinated hand. A rotation box (see Garrett⁷) is used in taking this measurement. The rotation box has been described above. The subject extends his right hand and grasps the knob between his thumb and forefinger. The knob points straight up (0°) at this point. The subject then rotates the knob 180° from zero to the subject's right. Hand clearance around knob (supinated hand) is measured from the most protrusive point on the hypothelar side to the most protrusive point on the thenar side of the supinated hand. Hand clearance around knob (supinated hand) of the clothed man is increased by gloves and mittens.

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